

MOSS FLORA

OF

NORTH AMERICA

North of Mexico

BY

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Subfamily HYLOCOMIEAE.

Mostly large robust mosses growing in wide loose mats or patches, usually on soil or stones in cool moist woods; branching often regularly pinnate or bipinnate, giving the plants a fern-like appearance; central strand of few cells; paraphyllia abundant to entirely lacking. Leaves imbricate to squarrose-spreading (secund in *Rhytidium* and *Rhytidiopsis*); costa single or double and varying greatly in length and thickness, never percurrent or excurrent; median leaf cells linear, sometimes papillose on the back by the thickening of the angles of the cell walls as in *Bryhnia*; angular cells little differentiated to rounded-quadrate and numerous; cell walls often incrassate, especially at base of leaf, where they are often somewhat colored and pitted (porose). Mostly dioicous; seta long and smooth; capsules large, rather short, unsymmetric and cernuous, resembling those of *Brachythecium*; calyptra cucullate; peristome perfect, having well-developed cilia.

KEY TO GENERA.

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|--|-----------------------------|
| 1. Paraphyllia lacking or very scarce..... | 2. |
| Paraphyllia present and abundant..... | 3. |
| 2. Leaves secund and strongly rugose, costa single, reaching middle of leaf or beyond..... | 1. <i>Rhytidium</i> . |
| Leaves spreading to squarrose, often plicate but not rugose; costa double, often strong..... | 3. <i>Rhytidiadelphus</i> . |
| 3. Leaves secund to falcate-secund, rugose; plants exclusively northwest American..... | 2. <i>Rhytidiopsis</i> . |
| Leaves loosely and regularly imbricate to squarrose-recurved, not rugose, rarely secund..... | 4. <i>Hylocomium</i> . |

1. RHYTIDIUM (Sull.) Kindb. Laubm. Schwed. und. Norw. 15. 1883.

Hyponum, subgenus *Rhytidium* Sull. Musc. & Hepat. U. S. 75. 1856.

Very robust, leafy stems often 4 mm. thick, irregularly divided and little branched to almost regularly pinnate; the *falcate-secund leaves more or less hooked at the ends of the stem and branches*; costa simple, reaching the middle of the leaf; paraphyllia lacking; pseudo-paraphyllia at axils of branches. Only one species known.

RHYTIDIUM RUGOSUM (Ehrh., Hedw.) Kindb. l. c.

Hyponum rugosum Ehrh. Dec. no. 291. 1793 and Hedw. Spec. Musc. 293, 1801.

Hylocomium rugosum DeNot. Epil. Bry. Ital. 99. 1869.

Plants in rather loose wide mats, yellow-green, often glossy; stems reaching about 12 cm. in length; ascending to erect; *pseudoparaphyllia found only in the axils of the branches; stem leaves crowded-imbricate, ovate-lanceolate, rather slenderly acuminate, reaching 3-5 x 1.5 mm., somewhat decurrent, plicate, *strongly rugose and secund; margin narrowly reflexed*, denticulate, especially above; leaf cells incrassate, *papillose on the back from the angles with strong forwardly directed papillae*, linear-flexuose, 6-8 μ wide, 8-10 : 1; *smaller, rounded-quadrate cells with thicker walls very numerous at the basal angles*; all basal cells shorter, subrectangular, thicker-walled and pitted, often colored; branch leaves smaller, less secund and less rugose. Dioicous; seta 2.5-5 cm. long; capsules strongly unsymmetric and cernuous, about 4 x 1 mm.; annulus of 3 rows of cells; operculum convex-apiculate to short-rostrate; spores in summer. Sporophytes found in Colorado and the Klondike only. Type locality European.

ILLUSTRATIONS:—Bry. Eur. *pl. 610*; M.H.M., *f. 143*.

EXSICCATI:—Drumm. Musc. Am. 198; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 326, (Ed. 2) 485; Aust. Musc. Appal. 450; Grout, N. Am. Musc. Pl. 26; R. & C. Musc. Am. Sept. Exsic. 200; Bartram, Mosses of S. Arizona 151.

On soil and ledges in comparatively dry and sunny places, more or less calcicolous.

Northern U. S. and Canada across the continent, south to N. Carolina, Arizona and New Mexico.

A very distinct and striking plant, easily recognized in spite of its variations by its thick stems and secund rugose leaves. *Antitrichia curtipendula* sometimes bears a striking resemblance to this species in leaf structure except that its leaves are not rugose and the costa is divided.

* *Pseudo-paraphyllia*, filaments or other growths not homologous with paraphyllia; apparently the first outgrowths that appear where a branch is to grow are so classed.

2. RHYTIDIOPSIS Broth. Engler & Prantl, Musci (Ed. 1) 1057. 1908.

This genus resembles Rhytidium strongly and was put in the same subgenus by Sullivant and by Lesq. & James. It differs chiefly in the abundant filamentose branching paraphyllia and double costa.

RHYTIDIOPSIS ROBUSTA (Hook.) Broth. l. c.

Hylocomium robustum (Hook.) Kindb. Cat. Can. Pl. 6: 250. 1892.

Hypnum Flemingii Aust. Bull. Torr. Bot. Club 5: 24. 1896.

Hypnum robustum Hook. Musc. Exot. pl. 108. 1820.

Plants robust, in rather wide loose masses, yellow-green above, brown below; primary stems creeping at base, ascending to erect above, sparingly divided or branching; stems and branches curved at the ends by reason of the strongly falcate-secund terminal leaves; leaves crowded, imbricate, secund, *plicate and transversely rugose*, concave, ovate-lanceolate, rather slenderly acuminate, 6-8 x 2-3 mm., somewhat rounded and narrowed to the insertion; margin plane or slightly involute at base, sharply dentate above, nearly entire at base; *costa double, stout, one limb usually longer and often reaching nearly to the middle of the leaf*; leaf cells incrassate and porose, the median narrowly linear-flexuose, 6-8 μ wide, about 12 : 1; basal shorter, broader, thicker-walled, and often somewhat colored; *angular cells little differentiated*, a few somewhat shorter and broader than the other basal cells; perichaetial leaves rather scarious and reflexed, slenderly long-acuminate, the inner spinose-dentate above, with costa thin or almost wanting. Seta 4 cm. or less in length; capsule oblong to oblong-cylindric, cernuous and arcuate when dry; urn about 3 mm. long, 3 : 1; operculum conic, papillose; spores in autumn.

Type locality, western N. America, Menzies.

ILLUSTRATIONS:—Hook. l. c.; Engler & Prantl (Ed. 2) 2: 478, f. 761, A-D; Pl. 30 A.

EXSICCATI:—Drumm. Musc. Am. 199; Allen, Mosses Cascade Mts. 118; Grout, N. Am. Musc. Pl. 65; Macoun, Can. Musc. 342.

On the ground in woods, alt. 500-7000 ft., Rocky Mts. and westward in the northern U. S. and Canada, east to Montana.

3. RHYTIDIADELPHUS (Lindb.) Warnst. Laubm. Krypt.-Fl. Mark. Brand. 842. 1906.

Hylocomium, subgenus C, *Rhytidiadelphus* Lindb. Musc. Scand. 37. 1879.

Robust rigid plants growing in loose wide tufts or mats, often mixed with other hypnaceous mosses; stems elongated, prostrate below, ascending to erect above, simple or irregularly divided, variously branched; pseudo-paraphyllia found only in the axils of the branches; leaves more or less crowded, the upper half spreading to squarrose-recurved, occasionally somewhat secund, more or less plicate; costa double, $\frac{2}{3}$ the length of the leaf, or sometimes almost lacking; median leaf cells narrowly linear, sometimes papillose by the thickening of the upper corners; angular cells in most species little differentiated; dioicous; seta smooth; capsule unsymmetric cernuous; peristome perfect; operculum conic.

Type species, *R. squarrosus* (L., Hedw.) Warnst.

KEY.

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| 1. Stem leaves spinose-papillose on the back, short-acuminate..... | 3. <i>triquetrus</i> |
| Stem leaves smooth at back, slenderly acuminate..... | 2. |
| 2. Stem leaves abruptly squarrose-recurved from the middle, scarcely plicate (except in var. <i>calvescens</i>)..... | 1. <i>squarrosus</i> . |
| Stem leaves mostly secund, strongly plicate..... | 2. <i>loreus</i> . |

1. RHYTIDIADELPHUS SQUARROSUS (L., Hedw.) Warnst. l. c. 918.

Hypnum squarrosus L. Sp. Pl. 1693. 1753; Hedw. Sp. Musc. 281. 1801.

Hylocomium squarrosus Bry. Eur. fasc. 49-51. pl. 492. 1852.

Plants green to yellow green, whitish below, soft for the genus; stems reaching 15 cm. or more in length, usually prostrate at base and ascending to erect above, more slender and flexuose than in the other two species, red below; central strand of few cells, or lacking; branches numerous, mostly short, slender and attenuate; stem leaves more or less crowded, imbricate, not secund, from an erect-sheathing cordate-ovate base abruptly recurved-squarrose and ending in a long slender channeled acumination, reaching 4 x 1.5 mm. or longer, spreading at ends of stems making them stellate-obtuse, not plicate, finely denticulate on the plane

margin, especially above, *not papillose*; costa comparatively short, double, scarcely reaching the middle of the leaf, or sometimes lacking; median leaf cells *thin-walled*, linear, 7-8 μ wide, 6-10 : 1; angular shorter and broader, *rectangular-hexagonal*, *very numerous*, *often colored or opaque*, forming large distinct but poorly delimited angular patches; branch leaves smaller, narrower and less squarrose. Dioicous; seta 2.5-3.5 cm. long; capsule red-brown, short, ovoid, unsymmetric; operculum conic-apiculate; annulus of 2 to 3 rows of cells; spores winter to spring.

Type locality European.

ILLUSTRATIONS:—Bry. Eur. l. c.; M. H. M. 268, f. 142.

EXSICCATI:—Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 282, (Ed. 2) 416; Aust. Musc. Appal. Suppl. 550; Grout, N. Am. Musc. Pl. 2 & 284; Allen, Mosses Cascade Mts. 123; Macoun, Can. Musc. 370.

On logs, soil and rocks in moist cool shady places; alt. from near sea level to 5000 feet. Northern U. S. and Canada across the continent, south to Pennsylvania and Tennessee. Often in shaded swampy places among grasses and sedges. Frequent in the mountains of New England, the Pacific slope of the U. S. and northwards.

North American plants of this species are much more variable than descriptions indicate. The plants may be almost as robust as *R. loreus* or slender and delicate as *Eurhynchium strigosum* when growing in shady grassy places. These slender forms often have bright red stems, leaves rather distant; stem leaves cordate-triangular and less recurved; the branch leaves abruptly short-acuminate to acute, with apices twisted or contorted; alar cells more differentiated with a much larger area of shorter and broader angular cells; branched or regularly pinnate.

This composite description of variations found in the *slender* forms is much like that given by Dixon for the var. *calvescens*, except that that variety is described as "more robust." I doubt if we have any forms properly referred to that variety and the variations enumerated above are not well enough correlated in the different plants studied to warrant naming forms or varieties. The blunt stellate ends of the leafy stems is characteristic of nearly all the forms, making them fairly easy to identify. In the next species the short newly developing stems are sometimes somewhat stellate at the ends but the older stems are more or less hooked by the second leaves.

2. RHYTIDIADELPHUS LOREUS (L., Hedw.) Warnst. l. c. 922.

Hylocomium loreum Bry. Eur. pl. 490.

Hypnum loreum L. Sp. Pl. 1127. 1753, and Hedw. Sp. Musc. 294. 1801.

Plants in loose intertangled mats, yellowish to gray-green; stems 10-20 cm. long, sparingly divided, flexuose, prostrate to ascending below, nearly erect above and usually somewhat hooked at the ends by the falcate-secund leaves, sometimes bright red, irregularly to subpinnately branching with numerous attenuate branches, which are often strongly stoloniferous at the ends; central strand not apparent; stem leaves sheathing at base, imbricate, more or less falcate-secund, strongly plicate, 3-5 x 1.2-1.7 mm., from a broadly ovate or ovate-oblong base rather abruptly or gradually narrowed to a long slender channeled and strongly recurved acumination; margins plane, finely denticulate; costa short and double or almost lacking; median leaf cells narrowly linear, about 7 μ wide, 8-12 : 1, occasionally longer, smooth; basal cells broader, shorter and thicker-walled, often colored; *alar cells scarcely differentiated*; branch leaves smaller and narrower. Dioicous; seta 2-4 cm. long; capsule short and thick, oblong-ovoid, unsymmetric and cernuous, 2-3 mm. long, about 2 : 1, slightly plicate when dry and empty; annulus of two rows of cells; operculum conic, long-apiculate; spores in spring.

Type locality European.

ILLUSTRATIONS:—Bry. Eur. l. c.; Pl. 30, C.

EXSICCATI:—Drumm. Musc. Am. 181; Allen, Mosses Cascade Mts. 125; Grout, N. Am. Musc. Pl. 6; R. & C. Musc. Am. Sept. Exsic. 348; Macoun Can. Musc. 372.

This resembles *R. squarrosus* in many ways but is easily differentiated in the field by the strongly plicate stem leaves which are also hooked at the stem-ends.

On soil, rocks and decayed wood, chiefly in moist subalpine forests. Northwestern U. S., and western Canada northwards, south to Oregon and Ontario, east to Newfoundland and Nova Scotia.

3. RHYTIDIADELPHUS TRIQUETRUS (L., Hedw.) Warnst. l. c. 920.

Hypnum triquetrum L. Sp. Pl. 1124. 1753 and Hedw. Sp. Musc. 256. 1801.

Hylocomium triquetrum Bry. Eur. fasc. 49-52. pl. 491. 1852.

Plants very robust, in large thick loosely intertangled mats or patches, bright to yellowish green; stems stout, stiff but elastic, inclined at base or entirely erect, 5-15 cm. or more in length, sparingly divided or simple; central strand few-celled; pseudo-paraphyllia in the branch-axils, *branching irregular and unequal*

or sometimes regular and equal but not complanate-pinnate; branches mostly attenuate; stem leaves averaging the largest of the genus, reaching 5 mm. or more in length, about 2 : 1, widely spreading wet or dry, when moist almost squarrose, rarely secund, stiff and scarious, cordate-triangular, rounded auriculate at the basal angles and narrowed to the insertion, somewhat decurrent, gradually narrowed above to a rather broad acumination, strongly plicate, denticulate nearly to the base, sharply dentate above; costa double with strong parallel limbs, often reaching $\frac{3}{4}$ the length of the leaf; median leaf cells linear, 6-7 μ wide, 6-10 : 1, rather thick walled; upper spinose-papillose on the back by projecting cell angles; lower and basal broader, shorter, hexagonal-oblong to rectangular, thicker-walled and pitted, a few at the extreme angles nearly as broad as long and often somewhat thinner-walled and slightly swollen. Dioicous; seta 3-4 mm. long; capsule oblong, unsymmetric, cernous to horizontal, 3-4 x 1-1.5 mm., smooth or widely striate when dry and empty; operculum acutely conic-apiculate, almost rostellate; annulus of 2-3 rows of cells; spores December to spring.

Type locality European, probably English.

ILLUSTRATIONS:—Bry. Eur. 1. c.; Jennings, Mosses W. Pa. *pl.* 43; M. H. M. 267, *f.* 141; *Pl.* 30.

EXSICCATI:—Drumm. Musc. Am. 182; Sull & Lesq. Musc. Bor. Am. (Ed. 1) 283, (Ed. 2) 417; Aust. Musc. Appal. 449; Allen, Mosses Cascade Mts. 124; Grout, N. Am. Musc. Pl. 64, Musci Perfecti 32; R. & C. Musc. Am. Sept. Exsic. 349; Macoun, Can. Musc. 371.

On the ground in rather moist and shaded places. Northern U. S. and Canada across the continent and northwards; south to N. Carolina, Missouri and California.

Common in mountainous and subalpine regions.

Var. *BERINGIANUS* (Card. & Thér.) Grout, Ck. List 18. 1929.

Hylocomium Card. & Thér. Proc. Wash. Acad. Sci. 4: 346. 1902.

Leaves yellowish, erect-imbricate to appressed-imbricate when dry; a few, especially at the stem ends somewhat secund. Type from Hall Island, Behring Sea, July 14, 1899 (Trelease 1899). Type seen and studied.

The original description says of the leaves "less papillose" but the leaves on the portion of the type studied were little different in this respect.

Also known from Blue Fox Island, Alaska, Mrs. M. B. Streeter; Kootenai Mts., Flathead Co., Montana, T. A. Bonser (Det. E. G. B.).

An arctic-alpine variation, little branched to almost simple in the plants seen and of a very different appearance from the type.

Var. *californicus* (R. & C.) Grout, 1. c. (*Hylocomium* R. & C. Bot. Gaz. 15: 61. 1890) is merely a very robust form with rugose undulate leaves.

4. HYLOCOMIUM Bry. Eur. fasc. 49-52. 1852.

Robust mosses of cool elevated regions. Stems stiff, bearing numerous filiform branching paraphyllia; branching irregularly pinnate to regularly bi- tri-pinnate; leaves broadly ovate-cordate to oblong, usually acuminate, concave; costa double (except in most forms of *H. pyrenaicum*), short or reaching to the leaf middle. Dioicous; capsule ovoid to oblong, unsymmetric and cernuous; peristome perfect.

Type species, *H. splendens*.

Key.

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| 1. Costa single, extending to the leaf middle, rarely forking..... | 4. <i>pyrenaicum</i> . |
| Costa double, usually not reaching middle of leaf..... | 2. |
| 2. Stem leaves rounded-obtuse..... | 2. <i>alaskanum</i> . |
| Stem leaves acute or acuminate..... | 3. |
| 3. Stems closely and regularly bi- tri-pinnate..... | 1. <i>splendens</i> . |
| Stems branching irregularly, or irregularly pinnate..... | 4. |
| 4. Stem leaves decurrent and coarsely toothed at base..... | 3. <i>umbratum</i> . |
| Stem leaves rounded-cordate at base and finely toothed..... | 5. <i>brevirostre</i> . |

1. HYLOCOMIUM SPLENDENS (Hedw.) Bry. Eur. 1. c. *pl.* 487.

Hypnum splendens Hedw. Sp. Musc. 262. *pl.* 67, *figs.* 7-9. 1801.

Hypnum proliferum L. Sp. Pl. 1125. 1753.

Plants robust, in wide loose patches, yellow-green to olive, brown below, stiff, more or less procumbent, reaching 20 cm. or more in length, usually shorter, consisting of arched ascending annual innovations arising from near the middle of the preceding year's growth, each seasons growth regularly bi- tri-pinnate and fern-like

in appearance, resembling a large *Thuidium*; central strand lacking; median branches 15–20 mm. long; branches and branchlets attenuate; paraphyllia much branched with capillary divisions, numerous on the main stems and branches, smaller and fewer on the branchlets; leaves at the base of the annual innovations scale-like, closely appressed; stem leaves loosely imbricate, broadly ovate, scarcely decurrent, abruptly narrowed to a flexuose acumination of varying length, 2–3 mm. long, about 2:1, concave, lightly plicate, somewhat transversely rugose toward the apex, more or less spinose-papillose on the back by projecting cell angles, strongly serrate above; basal margin recurved; costa double, usually short but occasionally reaching nearly $\frac{1}{2}$ the length of the leaf; median leaf cells linear-flexuose, rather blunt at ends, about 6μ wide, 7–10:1; basal cells shorter, broader and incrassate, colored and pitted; alar scarcely different; leaves of branches smaller, abruptly acute to acuminate, concave, not plicate; leaves of branchlets about 0.6×0.24 mm., gradually obtusely acute, margins incurved and more or less serrulate above. Dioicous; antheridia borne on the branches; archegonia on the main stems; seta 1.5–2.5 mm. long, light- to red-brown; capsule 3.5–5 mm. long including the beaked operculum, 1–1.5 mm. thick, light to dark brown, ovoid to oblong, unsymmetric, nearly or quite horizontal, slightly contracted under the mouth when dry and empty; annulus present; peristome perfect; spores in spring. Type locality European.

ILLUSTRATIONS:—Bry. Eur. l. c.; Hedw. l. c.; Jennings, Mosses Western Pa. pl. 43; M. H. M. 265; f. 140. Mosses with H-lens (Ed. 3) pl. 53; Pl. 31.

EXSICCATI:—Sull. Musc. Allegh. 1; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 285; Aust. Musc. Appal. 447; Drumm. Musc. Am. 218; Grout, N. Am. Musc. Pl. 42, Perfecti 94; Allen, Mosses Cascade Mts. 122.

Northern U. S. and Canada across the continent and northwards, south to N. Carolina, S. Dakota, Colorado and California!

On ledges, humus and decaying wood in cool moist ravines and mountain woods from sea level to 10,000 ft.

Early in the season the new shoots are simply pinnate and very characteristic, later they become bi-tri-pinnate with the *Thuidium*-like facies. Slender simply pinnate forms occur when the plants are crowded in among other plants. In dry exposed places the plants become reduced, sometimes more compact, resembling *Calliergonella Schreberi*, at other times slender and simply pinnate (= var. *gracilius* Boul.). *H. umbratum* is the only species likely to be mistaken for *splendens* but in *umbratum* the branching is in most cases much less regularly pinnate, and bushy instead of complanate; also the branches are more slenderly attenuate and paraphyllia very numerous even on the branchlets. R. S. Williams collected in Yukon Terr. a long slender bipinnate form reaching 15×2 cm. that has no apparent innovations.

2. HYLOCOMIUM ALASKANUM (Lesq. & James) Kindb. Cat. Can. Pl. 6: 248. 1892.

Hypnum alaskanum Lesq. & James Man. 405. 1884.

Resembling small forms of *Calliergonella Schreberi* but with stems bearing abundant paraphyllia; leaves minutely serrulate all around with very small teeth; margins flat above and strongly reflexed near the base; leaves concave, not plicate; leaf cells linear-flexuose, scarcely or very slightly pitted; basal cells golden-brown, alar scarcely differentiated; costa short and double.

ILLUSTRATION:—Bryologist, 22: 1. fig. 1. 1919; Pl. 31 A.
Alaska and British Columbia.

As there is a series of intergrading forms progressively approaching the Dall type as we go farther north, it seems best to treat *H. alaskanum* as an arctic subspecies of *H. splendens*, of which it is certainly a derivative. Specimens from different Alaskan localities identified by Williams have in some cases apiculate to acuminate stem leaves.

A Muir Glacier plant and other far northern forms of *splendens* have all the leaves of branches and branchlets more abruptly rounded at apex, much as shown in Williams' figures, but the stem leaves still have a short acumination which is more like a large apiculus than the acumination ordinarily found in *H. splendens*. The leaves are also relatively broader.

Limpricht makes *H. alaskanum* a variety of *splendens* and says of it "einfach gefiedert," but specimens of Dall's Alaskan collection (presumably from the type collection) from the James herbarium, now in the collections of the New York Botanical Garden, are twice pinnate. The branchlets have very few paraphyllia and the branch leaves occasionally have a few papillae on the back above.

3. HYLOCOMIUM UMBRATUM (Ehrh., Hedw.) Bry. Eur. fasc. 49–51, pl. 488. 1852.

Hypnum umbratum Ehrh. 1788 and Hedw. Sp. Musc. 263, pl. 67, figs. 10–13. 1801.

Plants with somewhat the habit of *H. splendens* but with the serial innovations less apparent, growing in loose irregular patches, dark green, brownish below, 15–20 cm. in length; annual innovations arched, rather irregularly pinnate or bipinnate but not in one plane, giving the plants a bushy appearance; branches and branchlets attenuate; stems reddish; central strand lacking; paraphyllia numerous on stems and branches,

rather broader at base than in *H. splendens*; stem leaves not crowded, often rather distant, somewhat spreading when moist, *triangular-cordate, longly and narrowly decurrent*, slenderly acute to long-acuminate, reaching 2 mm. long by 1.5 mm. broad, usually smaller, deeply and irregularly plicate; margin wavy and serrate with very strong unequal teeth, which may be spreading or even recurved; costa double, strong, reaching the middle of the leaf or even farther, often bearing one or more spines on the back; leaf cells not papillose at back, median linear-flexuose to linear-oblong, about 6μ wide, 6-10 : 1, basal shorter and broader, often colored, alar not differentiated; branch leaves smaller; leaves of branchlets ovate-lanceolate, more slenderly acuminate, with a much longer costa, one branch often reaching $\frac{3}{4}$ - $\frac{5}{8}$ the length of the leaf; perichaetial leaves squarrose-recurved at tips. Dioicous; antheridia on branches, archegonia on stems; seta 2.5-3.5 mm. long; capsule chestnut, ovoid, unsymmetric, nearly horizontal, 3-3.5 mm. long including operculum; operculum conic; "annulus lacking"; spores winter to early spring, rarely produced. Type locality European.

ILLUSTRATIONS:—Bry. Eur. l. c.; M. H. M. pl. 71.

EXSICCATI:—Sull. Musc. Allegh. 2; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 286; (Ed. 2) 420; Aust. Musc. Appal. 548; Grout, N. Am. Musc. Pl. 41; Macoun, Can. Musc. 368.

On stones, old logs and humus in moist shaded places in mountain woods or cold ravines; northeastern U. S. and eastern Canada, south in the mountains to N. Carolina and west to Ohio, Ontario and Alaska. Often confused with *H. splendens*. For distinctions see under that species. (In M. H. M. p. 267 the leaves are described as papillose on the back, by an accidental dropping of the word "not").

On the summit of Mt. Mansfield, Vt., and probably elsewhere, is found a condensed compact form closely corresponding to forma *alpina* R. & C., Musc. Eur. Exsic. 250. I regard this as simply an alpine habitat form.

4. HYLOCOMIUM PYRENAICUM (Spruce) Lindb. Musc. Scand. 37. 1879.

Hypnum pyrenaicum Spruce, Musc. Pyren. no. 4. 1879.

Hypnum Oakesii Sull. Mosses U. S. 673. 1848.

Hypnum fimbriatum Hartm. Scand. Fl. (Ed. 5) 330. 1849, and Bry. Eur. fasc. 49-51. pl. 489. 1852.

Plants robust, in rather thin loose mats, dark to yellowish-green, paler at stem and branch tips; stems procumbent with ascending, sparingly and irregularly branched secondary stems, reddish-brown, densely covered with much branched (often bipinnate) paraphyllia which are often attached to the base of the costa; terminal portions of stems and branches turgid with the loosely erect-spreading subscarioso leaves; median stem leaves broadly ovate, narrowed at base, sometimes slightly decurrent, acute to broadly short-acuminate, about 2.5 mm. long, 2 : 1; costa single, reaching about $\frac{1}{2}$ the length of the leaf; some lower leaves oblong, acute, with a short double costa; upper stem leaves with a longer, more slender twisted acumination; lower leaves often barely serrulate, the upper spinose-serrate above; all very concave, strongly plicate with margins recurved at base when dry, branch leaves similar but smaller; leaf cells not papillose at back, otherwise much as in the other species or a little shorter; basal and apical shorter and broader; basal colored, thick-walled and pitted; alar little differentiated; perichaetial leaves abruptly narrowed to a long slender recurved serrate acumination. Dioicous; seta 1-3 cm. long; capsule ovoid, unsymmetric, cernuous, 2.5-3 mm. long including the conic-apiculate operculum, about 2 : 1; annulus lacking; spores winter to early spring, rarely produced.

Type locality European.

ILLUSTRATIONS:—Bry. Eur. l. c.; Sull. Icon. Musc. pl. 102; Pl. 31B.

EXSICCATI:—Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 287, (Ed. 2) 421; Aust. Musc. Appal. Suppl. 549; Grout, N. Am. Musc. Pl. 146; Macoun, Can. Musc. 369.

On old logs and moist rocks in cool ravines or woods in mountains. Northeastern U. S., eastern Canada and northwards, south to Vermont and New Hampshire, west to Minnesota, Revelstoke, B. C., and the Yukon. Infrequent and local. (See Bryologist 14: 9 for an account of a freak form.)

5. HYLOCOMIUM BREVIROSTRE (Ehrh., P. B.), Bry. Eur. fasc. 49-51, pl. 493. 1852.

Hypnum brevirostrum Ehrh. Pl. Crypt. Exs. 85. 1788 and P. B. Prod. 61. 1805.

Plants in loose, dark green tufts, often yellowish above, stiff and robust, freely but irregularly branching, 5-15 cm. or more in length; stems reddish, erect or arched, often subdendroid; mature branches usually attenuate, young branches often stout, blunt and turgid; "central strand of a few thick-walled cells"; paraphyllia abundant but more slender than in the preceding species, freely branched but mostly one cell in thickness except at base; lower stem leaves rather distant, squarrose-spreading, broadly triangular-ovate, auricled and clasping, plicate, "slightly decurrent," abruptly narrowed to a rather slender channeled contorted acumination, 1.2-1.5 mm. long and nearly as wide; margins plane or incurved at base of acumination, serrate above, serrulate nearly to base, costa double, the longer branch often reaching beyond the leaf-middle; upper stem

leaves more crowded, erect-spreading when moist, more gradually long-acuminate, 2-3 mm. long, 1.5-2 mm. wide; costa double, rarely reaching more than $\frac{1}{3}$ the length of the leaf; median leaf cells linear-flexuose, rather blunt, about 7 μ wide, 5-7 : 1, cell walls rather thick and slightly pitted; basal cells shorter, broader and colored with thicker abundantly pitted cell walls; alar cells scarcely different; branch leaves smaller, less squarrose; perichaetial leaves slenderly long-acuminate, squarrose-spreading when dry, "the inner ecostate." Dioicous; male buds on branches, archegonial on stems; seta 15-25 mm. long; capsule oblong-ovoid, unsymmetric, cernuous to horizontal, red-brown, 3-3.5 mm. long including operculum, striate when dry; operculum conic-rostrate; annulus present; spores winter to early spring. Type locality European.

ILLUSTRATIONS:—Bry Eur. 1. c.; Jennings, Mosses W. Pa. pl. 44; Pl. 31.

EXSICCATI:—Drumm. Musc. Am. (S. States) 135; Sull. Musc. Allegh. 8; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 284, (Ed. 2) 418; Small, Mosses S. States 44; Macoun, Can. Musc. 373; Grout, N. Am. Musc. Pl. 44 & 44a, Musci Perfecti 219.

On moist rocks and soil in cold shaded ravines or swamps, usually in the mountains.

Nova Scotia to Ontario, south to Georgia and Missouri, not reported west of Ontario or the Mississippi River.

Distinguished by its coarse stiff habit, slender paraphyllia and squarrose cordate-auriculate sub-clasping stem leaves. It is less alpine than *umbratum* and is often found in the same general localities as *splendens*. Short depauperate forms lacking the characteristic squarrose-recurved leaves and bearing young undeveloped branches are misleading.

Subfamily HYPNEAE.

Plants of varied habit and habitat, often regularly pinnate and plumose; central strand often lacking; paraphyllia often present; costa short and double or lacking; leaves secund to falcate-secund in the majority of species, but with numerous exceptions; leaf cells smooth (papillose at back in a few cases), rhomboidal to linear-flexuose but usually more than 3 : 1 (exceptions in some genera); margins mostly plane, or sometimes recurved at base; alar cells usually differentiated, either enlarged and inflated or smaller and subquadrate; urn of capsules usually more than 2 : 1; peristome usually with cilia except in some forms with erect capsules; outer basal plates of peristome teeth marked with fine transverse lines.

KEY TO GENERA.

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|--|------------------------------|
| 1. Stem and branch leaves secund, often falcate..... | 2. |
| Stem leaves not falcate, rarely secund (except <i>Vesicularia</i> species)..... | 7. |
| 2. Alar cells inflated, usually hyaline..... | 3. |
| Alar cells not inflated, often smaller and subquadrate..... | 5. |
| 3. Operculum long-beaked..... | 4. |
| Operculum conic to short-rostrate..... | 1. <i>Hypnum</i> . |
| 4. Leaves entire or slightly serrulate; exothelial cell walls collenchymatous..... | 4. <i>Sematophyllum</i> . |
| Leaves sharply serrate; exothelial walls not collenchymatous..... | 2. <i>Brotherella</i> . |
| 5. Capsules erect and symmetric..... | 6. |
| Capsules unsymmetric to curved, cernuous; cilia present..... | 1. <i>Hypnum</i> . |
| 6. Peristomes without cilia, or cilia short and vestigial; plants usually found on the bark of living trees..... | 7. <i>Pylaisia</i> . |
| Peristomes with cilia; plants usually growing on rotten wood, humus or soil... | 1. <i>Hypnum</i> . |
| 7. Alar cells inflated and hyaline..... | 3. <i>Heterophyllum</i> . |
| Alar cells not inflated, mostly smaller and subquadrate..... | 8. |
| 8. Plants minute; leaves less than 0.8 mm. long..... | 6. <i>Amblystegiella</i> . |
| Plants larger; leaves 1 mm. or more in length..... | 9. |
| 9. Leaves papillose on the back above..... | 10. |
| Leaves not papillose..... | 11. |
| 10. Papillae at cell angles..... | 10. <i>Mittenothamnium</i> . |
| Papillae in the middle of the cells..... | 9. <i>Taxithelium</i> . |
| 11. Quadrate alar cells numerous, small..... | 12. |
| Quadrate alar cells few or none..... | 14. |
| 12. Capsules erect and symmetric; cilia lacking in the peristome..... | 8. <i>Platygyrium</i> . |
| Capsules unsymmetric and cernuous..... | 13. |

13. Plants short and compact, not filiform. 5. *Homomallium*.
 Plants slender, long-filiform, rare western. 11. *Tripterocladium*.
 14. Leaf cells hexagonal to elongated-hexagonal. 12. *Vesicularia*.
 Leaf cells linear-fusiform. 13. *Ectropothecium*.

1. HYPNUM L., Hedw. Sp. Musc. 236. 1801.

Plants large to slender, usually in densely intertangled mats, bright- to yellowish-green, sometimes golden-green, often glossy; stems prostrate to ascending or erect, simple or divided; branching irregular to regularly complanate-pinnate; ends of stems and branches often hooked by the strongly falcate-secund leaves; central strand of few cells present in most species; *paraphyllia* usually present, often broad and leaf-like; leaves falcate-secund, usually in two more or less regular rows with the points turned down (exclusive of *H. Crista-castrensis*); costa short and double or lacking; median leaf cells linear-flexuose, smooth (except *H. molluscum*) differentiated alar cells present in most species, small and quadrate or inflated and hyaline. Capsules oblong to cylindric, erect to usually more or less inclined or horizontal, nearly symmetric to strongly curved; operculum conic to short-rostrate; peristome perfect, cilia usually well developed. Occurring on all kinds of substrata.

Type species *H. cupressiforme*.

KEY.

1. Branching regularly pinnate. 2.
 Branching irregular or very irregularly pinnate. 18.
2. Alar cells conspicuously inflated, hyaline and thin-walled. 3.
 Alar cells little or not at all inflated, usually smaller and quadrate to rectangular. 5.
3. Stem leaves acute to broadly acuminate; capsules strongly plicate when dry and empty. 12. *arcuatum*.
 Stem leaves slenderly acuminate, often with filiform-acumination; capsules not plicate*. 4.
4. Leaves filiform-acuminate; stem leaves entire. 9. *callichroum*.
 Leaves slenderly acuminate; acumination not filiform, more or less serrulate above. 11. *Dieckii*.
5. Most leaves quite entire. 6.
 Most leaves distinctly serrate. 8.
6. Leaf base cordate-auriculate; plants very large. 23. *procerrimum*.
 Leaf base not cordate-auriculate (cordate but not auriculate in *subplicatile*); plants small to medium (for the genus). 7.
7. Leaf margins strongly revolute to near apex. 19. *revolutum*.
 Leaf margins plane. 10. *subplicatile*.
8. Leaf base cordate-auriculate, cells more or less distinctly papillose dorsally by projecting cell angles. 22. *molluscum*.
 Leaf-base not cordate-auriculate, cells smooth. 9.
9. Leaves strongly plicate, with apices curved towards the next lower branch. 21. *Crista-castrensis*.
 Leaf apices curved towards the substratum; leaves very slightly or not at all plicate when moist. 10.
10. Cuticular (cortical) stem cells large, 8-12 μ in diameter, hyaline. 11.
 Cuticular stem cells narrow. 12.
11. Plants small, cespitose; leaves rarely over 1 mm. long; capsules about 2.5 mm. long. 14. *hamulosum*.
 Plants medium sized to large; stem leaves over 1.5 mm. long; capsules 4-5 mm. long. 8. *subimponens*.
12. Capsules long-cylindric, erect and symmetric or slightly curved and inclined. 1. *imponens*.
 Capsules ovoid to subcylindric, unsymmetric or curved, inclined to horizontal. 13.

* *H. imponens* may be sought here.

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|---|--|
| 13. Quadrate alar cells very numerous (6-10 along the margin)..... | 14. |
| Quadrate alar cells few or lacking..... | 15. |
| 14. Leaves usually nearly entire, with a few larger cells at extreme basal angles; dioicous..... | 2. <i>cupressiforme</i> . |
| Leaves strongly serrate, with no enlarged alar cells; monoicous..... | 17. <i>reptile</i> . |
| 15. Capsules strongly plicate when dry..... | 4. <i>curvifolium</i> . |
| Capsules not plicate (very rarely slightly wrinkled)..... | 16. |
| 16. Capsules 3 mm. or more long, sometimes wrinkled..... | 5. <i>fertile</i> . |
| Capsules small, smooth, including operculum 2 mm. long (or even less)..... | 17. |
| 17. Leaves not much narrowed to the insertion; dioicous (reported from the eastern coast regions of Canada; doubtfully North American)..... | 7. <i>canariense</i> . |
| Leaves abruptly narrowed and rounded to the insertion; monoicous; plants of the Pacific slope..... | 6. <i>circinale</i> . |
| 18. Alar cells enlarged, inflated and hyaline; cuticular stem cells large and hyaline.*..... | 19. |
| Alar, and cortical stem cells not as above..... | 21. |
| 19. Plants with leaves strongly falcate-secund in two rows, with the habit of <i>cupressiforme</i> | 12. <i>arcuatum</i> . |
| Plants complanate-foliate, with the habit of a <i>Plagiothecium</i> | 20. |
| 20. Inflated alar cells abruptly enlarged, sharply delimited..... | 12. <i>arcuatum</i> var. <i>demissum</i> . |
| Alar cells gradually enlarged and not sharply delimited..... | 13. <i>pratense</i> . |
| 21. Leaves nearly or quite entire; plants arctic-alpine, calcicolous..... | 22. |
| Leaves serrulate or denticulate, at least above..... | 23. |
| Leaves entire or serrulate at base only..... | 20. <i>geminum</i> . |
| 22. Plants robust; leaves 1.5 mm. long..... | 15. <i>Bambergeri</i> . |
| Plants slender; leaves less than 1 mm. long..... | 16. <i>fastigiatum</i> . |
| 23. Quadrate alar cells very numerous, 6-15 in the marginal row..... | 24. |
| Quadrate alar cells comparatively few, less than 6 in the marginal row..... | 18. <i>pallescens</i> . |
| 24. Leaves serrulate nearly or quite to base..... | 17. <i>reptile</i> . |
| Leaves serrulate at apex only, some often entire..... | 25. |
| 25. Median leaf cells 10-15 : 1; quadrate alar cells 6-10 in the marginal row.† | 2. <i>cupressiforme</i> . |
| Median leaf cells 4-6 : 1; quadrate alar cells 12-15 in marginal row.... | 3. <i>Vaucheri</i> . |

Subgenus STERODON Mitt. Journ. Linn Soc. 12: 22. 1869.

Plants irregularly to pinnately branched, often so regularly branched as to have a frond-like appearance; leaves (with few exceptions) strongly falcate-secund, turned towards the substratum; leaf cells smooth.

I. HYPNUM IMPONENS Hedw. Sp. Musc. 290. pl. 77, figs. 1-5. 1801.

Plants in rather thin closely intertangled mats, rarely in thick cushions, dark to yellow-green above, brownish below; stems reaching 10 cm. in length, stiff, red to red-brown, prostrate, rather regularly and complanately branching; paraphyllia numerous for the genus, broad, often ciliate; stem leaves little or not at all decurrent, broadly triangular-oblong, rather gradually narrowed to a slender serrate acumination, narrowed and somewhat rounded to the insertion, strongly falcate-secund to circinate, curving down, concave, occasionally slightly wrinkled, about 2 x 0.6 mm., occasionally larger; margins plane or slightly recurved at base, serrulate; costa lacking or very short and double; median leaf cells linear-flexuose, about 6 μ wide, 6-10 : 1; basal broader, incrassate and colored, often a bright orange-brown; a comparatively few alar cells small and quadrate, 4-6 along the margin, at the extreme angles a number (3-4 on the margin) of larger, slightly inflated cells, clear but usually colored, all incrassate and forming small but distinct auricles; branch leaves much smaller, narrower, lanceolate, with fewer quadrate alar cells; perichaetial leaves plicate. Dioicous; seta 1.5-3.5 cm. long; capsule cylindric, nearly erect and symmetric or slightly curved, chestnut-brown when old, including operculum 3-4 mm. long, 4-6 : 1; operculum slenderly conic, long-apiculate to rostellate; annulus of 2-3 rows of cells; peristome perfect; spores autumn to early winter. Type locality European.

* *H. callichroum* may be sought here.

† *H. revolutum* may be sought here.

ILLUSTRATIONS:—Bry. Eur. *pl.* 597; Jennings, Mosses W. Pa. *pl.* 45; M. H. M. 351 & 352, *figs.* 184 & 185; Mosses with a Hand-lens (Ed. 3) *pl.* 57.

EXSICCATI:—Drumm. Musc. Am. 205. (as *H. cupressiforme*); Sull. Musc. Allegh. 16; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 321, (Ed. 2) 475; Aust. Musc. Appal. 418; Grout, N. Am. Musc. Pl. 8, 287 (an alpine form) & 318; R. & C. Musc. Am. Sept. Exsic. 137.

On soil and rocks but chiefly on rotting wood in moist shaded places. Abundant from Canada to Georgia, westward to British Columbia and California. Apparently less frequent or lacking in the far North and West where its place seems to be taken by *H. subimponens*. When sterile, often difficult to distinguish from *fertile* and *cupressiforme*. The number of small quadrate cells above the inflated alar cells seems to vary a great deal on the same plant. This species and *H. cupressiforme* are closely related and often intergrade, especially in England.

2. HYPNUM CUPRESSIFORME L., Hedw. Sp. Musc. 291. 1801.

Stereodon complexus Mitt. Jour. Linn. Soc. 8: 41. 1865.

Hypnum pseudofastigiatum C. M. & Kindb. Cat. Can. Pl. 6: 235. 1892. Type seen.

Plants exceedingly polymorphous, often closely approaching *H. imponens* in appearance, but from this it differs in its lighter color, rarely tinged with red, and in its irregular branching, fewer and narrow paraphyllia and leaves entire or slightly serrulate above, narrower, not decurrent, often more filiform-acuminate, not rugose or plicate; with margins plane throughout, *area of quadrate alar cells much larger (6-10 in marginal row) and inflated angular cells much fewer (2-3 in marginal row) in number*; median cells usually shorter and broader and basal slightly or not at all colored; perichaetial leaves not plicate. Capsules usually more curved, often shorter; operculum often rostrate; spores at about the same time but sparingly produced with us. Type locality European.

ILLUSTRATIONS:—Bry. Eur. *pl.* 594 & 595; M. H. M. 353, *f.* 186.

EXSICCATI:—Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 320 & 320b var.; Aust. Musc. Appal. 419, 423; Grout, N. Am. Musc. Pl. 161, 346, 393, 385 and 415.

On soil, bases of trees and rocks in moist shaded places, cosmopolitan. Widely distributed in N. America, ranging from the arctic regions to the Gulf of Mexico; from sea level to subalpine heights; rather rare and local in New England and neighboring territory, infrequent west of the Rockies.

From *H. imponens* it may usually be distinguished by its irregular branching, numerous and more dense quadrate alar cells and lack of pronounced red in the stems.

According to descriptions of Dixon and other European bryologists and the plates of the Bry. Eur. the var. *ericetorum* Bry. Eur., differs from *imponens* in little but the pale green color, but most herbarium specimens seem to be less regularly pinnate and more loosely foliate, having the capsule more curved with a plainly beaked operculum in characteristic specimens. R. & C. Musc. Am. Sept. Exsic. 138.

There are several very markedly slender forms, which have been dignified as varieties or even species, that to my mind are probably largely due to habitat conditions.

Var. RESUPINATUM (Wils.) Schimp.

Heterophyllum pseudo-nemorum Kindb. Eur. & N. Am. Bryineae 123. 1896. Type seen.

Slender with branches often almost filiform, leaves straight or slightly curved, homomallous or erect, narrow, entire or denticulate; capsule erect and nearly or quite symmetric; operculum rostrate.

According to Dixon var. *resupinatum* when typical has the appearance of a *Pylaisia* due to the homomallous leaves. Aust. Musc. Appal. 422.

Var. FILIFORME Brid. Musc. Rec. 22: 138. 1801. Plants extremely slender with long straight filiform branches; leaves small, branch leaves rather erect-spreading or somewhat secund; capsules rare, small. Usually on trunks of trees, occasionally on more or less perpendicular rocks. N. Am. Musc. Pl. 31.

Dixon describes var. *filiforme* as having the leaves "very regularly and neatly imbricate in two rows, falcato-secund or hamate" but Bridel, the author of the variety says "*foliis in ramulis patentiusculis rectis.*" (Bryol. Univ. 2: 609. 1827) and most European authors agree, though allowing that the leaves may be somewhat secund.

Bridel states in a note on the same page that the filiform branches are appressed to the bark of the tree and the subcapillary leaves, scarcely reflexed, are due to the rain water which seems to run down the bark of the tree. A similar effect is produced by dripping water in *Homalothecium Nuttallii* var. *hamatidens*.

Var. SUBJULACEUM Mol. Moost. Alg. Alp. 107. 1865. Includes the robust forms of Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 473; Sull. Musc. Allegh. 70 as *Leskea flaccida*, with nearly erect leaves, is near this variety; branchlets sharp-pointed (Moenkemeyer). Apparently plants of dry rocks and soil. Arizona.

Bridel in 1812 enumerated no less than 19 varieties of this puzzling species. But the larger forms with strongly falcate-secund leaves and numerous subopaque quadrate alar cells are not difficult to identify, al-

though in these forms there are great variations in size, color (from a pale brownish-green to very dark greenish-brown with rarely a tinge of red), length and slenderness of the leaf acumination, serration of the margin and length of leaf cells. Also variable are the length and curvature of the capsule and length of beak or apiculus of the operculum. Yet these variations seem so poorly correlated as to make it difficult to define readily recognizable varieties, especially as most forms fruit sparingly.

The Lesq. & James Manual credit us with var. *lacunosum* Brid. (var. *elatum* Br. & Sch.), a very robust form approaching small forms of *Rhytidium rugosum* in appearance; branches very few and tumid; leaves very wide and concave with only the apices secund, entire or nearly so, shortly acuminate.

Austin's Musc. Appal. 420 is probably correctly referred to var. *resupinatum* while Grout, N. Am. Musc. Pl. 31 is intermediate between vars. *respinatum* and *filiforme*. Austin's 423 shows rather typical stems giving rise to filiform branches. His 421 is so depauperate as to be hard to place but it seems nearest a form of var. *ericetorum*. His 422 may be considered as a small slender *subjulaceum* or a robust *resupinatum*.

I have carefully examined the type of *Hypnum complexum* and the only distinction between it and *H. cupressiforme* is that the inner perichaetial leaves are strongly plicate. This character is scarcely enough to found a species upon in so variable a group of forms as *H. cupressiforme* and its varieties. The type of *H. complexum* is merely a slender northern form of *cupressiforme* in which the small quadrate alar cells in most cases reach to the leaf insertion. Mitten himself says of it, "In general appearance very similar to that form of *H. cupressiforme* known as *tectorum* but its affinity is in other respects with *H. reptile* . . . but the present species is certainly dioicous, more robust, and with scarcely serrulate leaves." *Hypnum hamulosiforme* Kindb. is one of the variations of *H. cupressiforme*. The only specimen of *Hypnum pseudo-complexum* Kindb. Rev. Bryol. 22: 85, in the Kindberg herbarium, 1895 is not the type. It is apparently a tufted form of *H. cupressiforme*.

*3. HYPNUM VAUCHERI Lesq. Cat. Mousses Suisse 48. 1845. (not of Bry. Eur. or Lesq. & James Man. 414). *Hypnum subcomplexum* Kindb. Rev. Bryol. 22: 88. 1895. Type seen.

A calcicolous subspecies of *H. cupressiforme* growing in dense thick cushions or mats, yellowish-brownish-green; secondary stems ascending to suberect, freely divided and branching, sometimes pinnate; leaves more or less falcate-secund, concave; margins plane, entire or sinuate above; stem leaves ovate to broadly ovate-lanceolate, rather abruptly narrowed to a comparatively short acumination; costa double, usually short, sometimes wanting, sometimes with one branch extending $\frac{1}{3}$ the length of the leaf, all three forms occasionally occurring on the same plant; leaf cells broader and much shorter than in *cupressiforme*; median about $7\ \mu$ wide, $4-6:1$ ($6-8:1$, Barnes Key), thick-walled and often pitted; small quadrate alar cells very numerous, $12-15$ in marginal row, extending $\frac{1}{2}$ way to leaf middle with no enlarged cells at the angles; branch leaves similar but smaller. Dioicous.

*"The pedicel is up to 15 mm. high, capsule short cylindric, about $2\frac{1}{2}$ mm. long with the lid, slightly curved and erect or nodding. Lid acute, its height about equaling basal diameter. Annulus broad, 2 or 3 rows of cells high. Two or three smooth cilia between segments."

Type locality Switzerland, Jura Mts.

ILLUSTRATIONS:—Husnot, Musc. Gall. pl. 117; Moenkem. Laubm. Europas 884, f. 213g; Pl. 32.

EXSICCATI:—Grout, N. Am. Musc. Pl. 264 & Supplement 21; R. & C. Musc. Am. Sept. Exsic. 342.

On calcareous rocks chiefly, rarely on soil (Nebraska). Said to be subalpine in Europe. British Columbia, Alberta, Dawson, Quebec, Newfoundland, Anticosti Island, Minnesota, Montana and Grand Canyon of Arizona, Utah; Lincoln Bay, Grant Land.

It grades into *H. cupressiforme* through its var. *subjulaceum*; where to draw the line is a matter of taste. The typical forms are well characterized and easy to recognize. In a letter to R. S. Williams Kindberg admitted that his *H. subcomplexum* is a synonym of *H. Vaucheri*.

4. HYPNUM CURVIFOLIUM Hedw. Sp. Musc. 285. pl. 75. 1801.

Plants large for the subgenus, in wide loosely interwoven mats, green to yellow-green, brown below; stems 5-10 cm. long, red-brown when old, irregularly divided; in well developed plants pinnately and complanately branched, but often irregularly branched; branches unequal; paraphyllia few or lacking; leaves very regularly and evenly falcate-secund in two rows, giving a characteristic plaited appearance to the plants; stem leaves $1.5-2 \times 0.7-0.8$ mm., elongated triangular-ovate, gradually long-acuminate, concave,

* R. S. Williams Bull. N. Y. Bot. Garden 2: 376, describing specimens from Montana.

channeled above, with plane margins, entire or serrulate near apex, narrowed and rounded to a subcordate base at insertion, somewhat decurrent; the decurrent cells enlarged, thin-walled and hyaline; above these on the curve of the base a few small short-oblong cells; median cells linear-flexuose, $\pm 6 \times 50-75 \mu$, near the base becoming shorter, broader, thicker-walled, pitted, and often colored; costa lacking or short and double; branch leaves smaller, more strongly falcate-secund and more serrate; perichaetial leaves sheathing, ecostate, the inner with several plicae. Dioicous, male and female plants growing intertangled; seta about 2.5 cm. long, red-brown below; capsule light-brown, darker with age, oblong-arcuate, inclined to horizontal, *plicate and somewhat contracted under the mouth when dry and empty*, including the operculum 2.5-4 mm. long; annulus large; operculum conic-apiculate; peristome perfect; spores in spring.

Type locality, Lancaster, Pennsylvania, Muhlenberg.

ILLUSTRATIONS:—Hedw. l. c.; Sull. Icones. Musc. *pl.* 114; M. H. M. 354, *f.* 187; Mosses with H-lens 178, *f.* 78.

EXSICCATI:—Drumm. Musc. Am. 197, S. States 148; Sull. Musc. Allegh. 12; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 323, (Ed. 2) 480; Aust. Musc. Appal. 424; Grout, N. Am. Musc. Pl. 49, 49a, Musci Perfecti 231; R. & C. Musc. Am. Sept. Exsic. 424.

On decaying wood, stones and soil in cool moist elevated forests, from arctic America south to Georgia and Missouri in the east and to Colorado in the west. Common, especially in the mountains of the north-eastern U. S.

Inundated forms are often dark brown except the young tips and occasional colonies occur in which the capsules are scarcely plicate.

5. HYPNUM FERTILE Sendt. Denksch. Bot. Ges. z. Regensburg 3: 147. 1841.

Hypnum pseudocircinale Kindb. Ottawa Nat. 14: 83. 1900. Type seen.

Plants resembling slender *Hypnum imponens*, growing in wide thin closely interwoven mats, light or yellowish green, brownish below; stems mostly procumbent and attached by numerous radicles, rather rigid, reaching 10 cm. in length, reddish brown when old; branching regularly and complanately pinnate as a rule, with rather short and uniform branches; *paraphyllia narrower and less numerous than in imponens*; leaves close, strongly falcate-secund to subcircinate, *not decurrent*; stem leaves oblong-lanceolate, gradually narrowed to a long slender acumination, rounded and narrowed slightly to the insertion, subclasping, 1.5-2 x 0.4-0.5 mm.; *margins plane, entire below, serrulate near the apex*; costa usually short and double, sometimes lacking; median leaf cells linear-flexuose, 6-7 μ wide, 10-15 : 1; basal cells usually colored, thick-walled and pitted; at the extreme angles *just below where the narrowing begins is a small group of oblong slightly inflated and pellucid cells* (1-2 on the margin) bordering these a few (3-4) smaller denser subquadrate cells just below and in the rounded basal angles which are more or less colored; branch leaves smaller and narrowed, usually more strongly falcate and serrate; inner perichaetial leaves *strongly plicate*, 3 mm. or more long, lanceolate with a very long almost filiform, serrate acumination, more or less costate; costa thin but sometimes reaching nearly to the leaf-middle. *Monoicous*; seta reddish, 1.5-2.5 cm. long; *capsule orange-brown, arcuate-cylindric, more or less cernuous*, with operculum about 3 mm. long, 4-5 : 1, contracted below the mouth when dry and empty and often plicate; annulus large; operculum conic-apiculate; peristome perfect; *spores in early summer*. Type locality European.

ILLUSTRATIONS:—Bry. Eur. *pl.* 591; Jennings, Mosses W. Pa. *pl.* 45; M. H. M. 356, *f.* 189.

EXSICCATI:—Aust. Musc. Appal. 417; Grout, N. Am. Musc. Pl. 54, 54a & 456 and Musci Perfecti 59. On decaying wood in moist cool shaded places, chiefly in elevated regions from Newfoundland and Nova Scotia to British Columbia, southwards east of the Rockies to Tennessee and N. Carolina. Abundant in the mountain woods of southern Vermont and probably frequent elsewhere in New England.

H. fertile often grows intertangled with *H. imponens* and is often confused with it. However it is somewhat more slender and usually lighter colored, the stems are rarely, if ever, such a dark red; the leaves are narrower; the stem leaves entire except near the apex; the alar cells are of a similar pattern but on a much smaller scale. When in fruit the smaller arcuate capsules ripening in June make recognition easy.

6. HYPNUM CIRCINALE Hook. Musc. Exot. *pl.* 107. 1820.

Hypnum sequoieti C. Muell. Fl. 58: 91. 1875.

Rhynchostegium pseudo-recurvans Kindb. Note on Canadian Bryology 1893 and Eur. and N. Am. Bryineae 140. 1896, according to Mrs. Britton, Bryol. 5: 66.

Plants in wide closely interwoven mats of medium thickness, light green above, brown below; stems \pm 5 cm. long, dark red when mature; branching regularly pinnate; branches short, sometimes of uneven length; paraphyllia few or lacking, in the axils of the branches there are usually bunches of short filaments; radicles

numerous on the under side of stems; stem leaves falcate-secund, slightly decurrent, subclasping, *lanceolate-subulate from a subcordate base, narrowed and rounded to the insertion, gradually narrowed above to a long slender, more or less serrulate acumination*, $\pm 2 \times 0.6$ mm., concave with plane margins; branch leaves smaller, circinate-falcate, more strongly serrate; median leaf cells $\pm 6 \mu$ wide, 8-15 : 1; basal shorter, thick-walled and colored, two or three decurrent angular cells larger and clear, above these a small group (2-4 on the margin) of small subquadrate cells which lie just below the curve of the rounded basal angles; costa lacking, occasionally showing short double traces; perichaetial leaves neither plicate nor costate. *Monoicous*; sporophyte small throughout; seta 1-2 cm. long, red brown; capsule brown to red-brown when old, oblong-ovoid, unsymmetric and nearly horizontal, not contracted below mouth, *including operculum ± 2 mm. long; urn about 2 : 1*; *operculum conic-apiculate to short-rostrate, about $\frac{1}{2}$ the length of urn; annulus present; peristome perfect; spores late autumn to early winter. Type locality Western N. America, Menzies.

ILLUSTRATIONS:—Hooker, l. c.; *Pl.* 32.

EXSICCATI:—Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 474 is type of *sequoieti* and is surely *H. circinale*; Grout, N. Am. Musc. Pl. 74; Allen, Mosses Cascade Mts. 120; R. & C. Musc. Am. Sept. Exsic. 341 and 341b. On bark of trees, decaying wood and stones along the Pacific coast from California to Alaska, common; east to Idaho.

Easily distinguished in fruit from all but the rare eastern *H. canariense* by the small capsules.

7. HYPNUM CANARIENSE (Mitt.) Dixon. & Jam. Handb. Brit. Mosses (Ed. 1) 477. 1896.

Stereodon canariensis Mitt. Journ. Linn. Soc. 8: 5. 1864.

Hypnum Waghornei Kindb. Cat. Can. Pl. 6: 234. 1892.

Plants resembling *H. circinale* in size, appearance and fruit; leaves less narrowed to the insertion and with more numerous quadrate alar cells; median leaf cells shorter and broader: dioicous. Newfoundland, New Brunswick and Cape Breton Island. Differs from *H. cupressiforme* in the fewer quadrate alar cells, the more serrate leaves and the short, relatively thick capsule, about 2 mm. long with lid. *Pl.* 35.

"Nearly resembling *S. cupressiformis*, Brid., in the state called "mammillatus," but differing from all states of that variable moss in the sharp serrulation of its leaves and in the size of the cells—about half as long and nearly twice as wide. In some specimens the capsule is very short—not longer than wide." Mitten. Journ. Linn. Soc. 8: 6. 1864.

I have been unable to see any authentic material of this species and it is very doubtful if it occurs in North America.

8. HYPNUM SUBIMPONENS Lesq. Trans. Am. Phil. Soc. 13: 14. 1863.

Stereodon plumifer Mitt. Journ. Linn. Soc. 8: 41. 1865.

Plants in wide rather thick, closely intertangled mats, yellow-green above, brown below; stems 5-10 cm. long, *green to brown, not red*; cortical cells large 8-12 μ in diameter, thin walled; branching regularly complanate-pinnate; branches short, more or less equal; paraphyllia few and small; stem leaves strongly falcate-secund, not decurrent, oblong-lanceolate more or less rounded and narrowed to the insertion, gradually narrowed to a long filiform acumination, 1.5-2 \times 0.5-0.65 mm., entire or distantly denticulate near apex, concave, often slightly plicate; margins plane; costa short and double or lacking; median leaf cells narrowly linear-flexuose, about 6 \times 45-70 μ ; basal cells shorter, broader, with thicker walls and pitted at insertion; a *very few* (3-4, rarely more, along the margin) *subquadrate slightly different cells at extreme basal angles*; branch leaves smaller, narrower and more serrulate, subcircinate; perichaetial leaves ecostate, plicate or smooth, filiform-acuminate and sharply serrate above. Dioicous; seta light-brown, red-brown at base when old, about 2.5 cm. long; *capsule light-brown, cylindric, more or less curved and inclined*, with operculum about 5 mm. long; operculum conic-apiculate, occasionally rostellate; annulus large; peristome perfect; spores in April. Type from Marin Co., California.

ILLUSTRATIONS:—Sull. Icon. Musc. Suppl. *pl.* 79; *Pl.* 32.

EXSICCATI:—Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 475, (Ed. 2) 476; Grout, N. Am. Musc. Pl. 17, Perfecti 113; Allen, Mosses Cascade Mts. 121; Baker, Pacific Coast Bryophytes 413, 554, 575 & 576; R. & C. Musc. Am. Sept. Exsic. 136 and 136b.

Apparently common in cool moist woods west of the Rockies, from California to Alaska. Reported by Macoun from N. Brunswick and Newfoundland. Resembling *H. imponens* in gross appearance but distin-

* Hooker figured the operculum as short-conic but Allen's 120 has operculum ranging from conic to short-rostrate.

guished by the characters italicised. It is distinguished from *H. fertile* by the cortical cells, the fewer differentiated alar cells and less curved non-plicate capsules.

Var. *CRISTULUM* Kindb. Bull. Torr. Bot. Club. 17: 280. 1890.

Appearance of *H. molluscum*, leaves circinate, some faintly striate. On rocks, southern part of Vancouver Id., Macoun (Described from Macoun's Can. Musc. 881a in my herbarium).

In the herbarium of the New York Botanical Garden are two specimens from the Mitten Herbarium labeled *Hypnum plumifer* and marked "type" by Mrs. Britton. One of these, collected by Drummond, is principally, if not wholly *Hypnum revolutum*. The other from "Columbia, Douglas" is *H. subimponens*. As I can find no trace of *Hypnum subplumiferum* (Mitt.) Card. except in Engler & Prantl (Ed. 2) Musci, 2: 455, I surmise it is a misprint for *H. plumiferum*.

9. HYPNUM CALlichroum Brid. Bryol. Univ. 2: 631. 1827.

Plants in wide soft tufts, bright- to yellow-green; stems more or less regularly pinnate, resembling in appearance several of the preceding species, green or brown; *cortical cells large and hyaline*; paraphyllia few, filamentous to lanceolate; *leaves beautifully circinate-secund*, usually very entire, broadly oblong-lanceolate, concave, gradually narrowed to a long filiform acumination, 1.5-2 mm. long, slightly decurrent; median leaf cells narrowly linear-flexuose, 10-15 : 1; *alar and decurrent cells (2-4 marginal) hyaline-inflated*, reaching half way to middle of leaf base, bordered above by a few (3-4 marginal) small subquadrate cells; branch leaves often subserrulate. Dioicous; capsules rather large, including operculum reaching 2.5-3.5 mm. in length, cylindric-arcuate, orange-brown; spores in summer. Type locality European.

ILLUSTRATIONS:—Bry. Eur. pl. 596; Pl. 32.

EXSICCATI:—Grout, N. Am. Musc. Pl. Suppl. 13.

On soil and stones in cold or mountainous regions. Very rare in North America; Greenland, Nova Scotia, British Columbia, Alaska.

The only Alaskan specimen of *H. Alaskae* Kindb. Eur. and N. Am. Bryinae 142. 1896 in the Kindberg herbarium is *H. callichroum*. It is probably the type.

10. HYPNUM SUBPLICATILE (Lindb.) Limpr. Laubm. 3: 494. 1899.

Stereodon plicatulus (non Mitten 1865) Lindb. in Contrib. ad Flor. Crypt. Asiae-bor-or. 254. 1872.

Plants in rather thin interwoven mats, bright yellow-green; stems prostrate, 5-8 cm. long; branching beautifully and regularly complanate-pinnate when fully developed; cortical cells large, thin-walled; paraphyllia few; stem leaves scarcely decurrent, strongly falcate-secund to circinate, not plicate, triangular-ovate from a subcordate base, abruptly narrowed and rounded to the insertion and gradually narrowed to a long slender subfiliform acumination, about 1.5 x 0.6 mm.; margins plane and nearly or quite entire; costa short and double; median leaf cells linear-flexuose, about 5 μ wide, 8-12 : 1; at rounded basal angles a small group of small subquadrate alar cells; the larger clear cells that are sometimes found below these are apparently cortical stem cells torn off with the leaf; branch leaves smaller and narrower, lanceolate and often serrulate above, less cordate at base. Dioicous; seta 1-1.5 cm. long; capsule light brown, obovoid, inclined and slightly unsymmetric, with lid about 1.5 mm. long; operculum short-conic; annulus large; peristome perfect; spores spring to early summer. Type locality Sachalin Island. Pl. 33.

William's plants from Lake Lindeman, Yukon Terr., "on damp rocks, May 30, 1898. No. 751" fit Limpricht's description (Laubm. 3: 494) almost exactly. The leaf base is much like that of *H. fertile* though more cordate and triangular instead of oblong-lanceolate; the cortical cells are larger and the capsule much shorter and only slightly unsymmetric. The smaller size and lack of inflated alar cells distinguish it from *H. callichroum* and the subcordate leaf base and short capsules from *H. subimponens*.

Hypnum implexum R. & C. Bot. Gaz. 22: 5. pl. 5. 1896.

Specimens of this species have not been available but the description and illustration match *H. subplicatile* very closely and I am unable to differentiate the two. The illustrations of the plants of *H. implexum*, type, from Seal Island, Labrador, certainly fit the Lake Lindeman plants.

11. HYPNUM ДИЕКИИ R. & C. Bot. Centralbl. 44: 423. Dec. 1890.

Hypnum canadense Kindb. Bull. Torr. Bot. Club. 17: 280. Nov. 1890.?

Intermediate between *H. arcuatum* and *H. callichroum*; described by Renauld and Cardot as follows. "Tufts yellowish or rufescent; stems depressed, pinnate; branches ascending; leaves falcate-secund, strongly circinate, from a broadly ovate base abruptly acuminate, acute or subulate, acumination plicate at base; margins plane, entire, rarely slightly denticulate above; costa double, short, sometimes very faint, at other times prolonged to middle; cells linear, very narrow; alar large, strongly inflated, hyaline or flavescent;

perichaetial leaves oblong-lanceolate, long-acuminate. Dioicous; capsule horizontal or subpendulous, large, arcuate." Operculum conic-apiculate.

Type from near Hector, Rocky Mts. at the summit level of the Canadian Pacific R. R., alt. 5,300 ft.

ILLUSTRATION:—*Pl.* 33.

EXSICCATI:—Grout, N. Am. Musc. Pl. 99 as *H. callichroum*, det. later as *H. Dieckii* by Cardot; Allen, Mosses Cascade Mts. 121b, as *H. subimponens*. Differs from *H. arcuatum* in the longer and more slender acumination of the circinate leaves, with rather less prominent alar cells; the basal cells more incrassate, pitted and colored; and in the non-plicate capsules. From *H. callichroum* it differs in the lighter color, ovate to ovate-lanceolate leaves, less slenderly acuminate and more often serrate and its much larger capsules. *H. canadense* is described as more or less serrulate all around. The serration in the leaves of this group is greatly variable even on the same plant. Both *H. Dieckii* and *H. pratense* have the large cortical stem cells of the group.

On decaying wood and stones in wet places, usually near streams. Washington, Oregon, British Columbia and Alaska.

The type of *H. canadense* appears to be lacking in the Kindberg herbarium; in the 19 specimens identified by Kindberg in his collection as this species were several of *H. Dieckii*, one *H. callichroum*, one *H. arcuatum* and one *H. imponens*.

12. HYPNUM ARCUATUM Lindb. in Hartm. Handb. Skand. Fl. (Ed. 8) 516. 1861.

(*H. arrenatum* on p. 345 by a typographical error.)

Hypnum Patientiae Lindb. Oefv. K. Vet. Akad. Foerh. 371. 1862.

Hypnum Lindbergii Mitt. Seeman's Journ. Bot. 1864.

Hypnum pseudo-drepanium C. M. & Kindb. Macoun, Cat. Can. Pl. 6: 240. 1892.

Hypnum Renauldii Kindb., Macoun, Cat. Can. Pl. 6: 238. 1892.

Hypnum arcuatum Hedw. Sp. Musc. 245. 1801 is a *Rhacopilum* and of Sull. 1854 is an *Ectropothecium*.

Plants in wide, rather loose mats of moderate thickness, bright to yellowish green, glossy, brown below; stems prostrate to ascending with ascending to suberect divisions, reddish below; branching irregular to almost regularly pinnate with branches of unequal length; cortical cells large and hyaline; stem leaves 1.8–2.5 x ± 1 mm., ovate-oblong, broadly acuminate, acute, or blunt at apex, falcate-secund in two rows, sometimes slightly plicate or rugose when dry, hooked at ends of stems and branches, concave, usually flat at apex but sometimes channelled, entire or serrulate at apex, decurrent; margins plane; costa short and double or lacking, occasionally 1 branch longer and reaching ½ length of leaf; median leaf cells about 5 μ wide, 12–20 : 1; apical cells shorter, oblong; basal shorter, broader, thick-walled and pitted, often colored with age; at decurrent angles a considerable area (2–4 cells on the margin and reaching about half way to the middle of the leaf base) of abruptly inflated thin-walled and hyaline alar cells; above these a few smaller irregular to subquadrate cells. Dioicous; seta about 2.5 cm. long, light brown, red-brown with age; capsule oblong-cylindric, arcuate, inclined to horizontal, plicate when dry and empty but not much contracted below the mouth, light brown, darker with age, with lid about 2.5–3.5 mm. long; annulus large; operculum conic-apiculate; spores in June. Type locality European.

ILLUSTRATIONS:—Limpricht, Laubm. 3: 499, f. 424; Jennings, Mosses W. Pa. pl. 46; M. H. M. 355. f. 188.

EXSICCATI:—Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 323b (as *H. curvifolium* var.), (Ed. 2) 481; Grout, N. Am. Musc. Pl. 118, 128, 141, 443; Musc. Perfecti 180. Aust. Musc. Appal. 426 as *H. pratense* var.

As a rule the leaves are only a trifle (or not at all) narrowed and rounded just above the hyaline alar cells. This, the much more numerous inflated alar cells and the large hyaline cortical stem cells distinguish most forms readily from *H. curvifolium*. The leaf apices are usually almost flat but in some of the more slenderly acuminate forms they may be channelled. There is a great variation in the length and slenderness of the acumination. On the one hand slenderly acuminate western forms seem to grade into *H. Dieckii*, while in the south the leaves of var. *americanum*, at least in part, may be broadly rounded-obtuse and spoon shaped at apex.

Apparently European forms have the capsule less strongly plicate than the American. The species is also exceedingly variable in the matter of branching, but on the whole is so well characterized as to be readily distinguished in most cases from related species except perhaps *H. pratense*, which see.

Growing chiefly on wet swampy soil, often among grasses. Common in the north-eastern U. S. Including the varieties, this species ranges from arctic America to Florida in the East and to Colorado, Washington and British Columbia in the West.

The type of *H. Renauldii* has been examined. The capsules are strongly plicate.

Var. ELATUM Schimp. Syn. (Ed. 2) 758. 1876.

The extreme form of the erect robust plant with *Drepanocladus* habit; stems 5–8 cm. long; leaves usually

narrower and more slenderly acuminate, strongly falcate-secund, almost circinate, often somewhat plicate. Occasional.

Var. *DEMISSUM* Schimp. l. c.

In thin light- to yellow-green mats; stems creeping with the habit of *H. pratense*. Occasional.

Var. *AMERICANUM* R. & C. Bot. Gaz. 14: 99. 1889.

"Differs from the typical form in the stems, slender, prostrate, more or less distinctly pinnate and the leaves smaller, with the acumen shorter and broader, blunt and usually denticulate at apex."

"Louisiana; Baton Rouge (Langlois)." N. Am. Musc. Pl. 420. as *H. pratense* var.

The common form in Florida and probably in the other Gulf States. Besides the blunt and rounded apex, the basal areolation is looser. Although abundant on the edges of swamps in Florida, I have never seen capsules.

Renauld in a post card written Jan. 23, 1902 wrote ". . . Je doute que le dernier (i. e. *Hypnum Renauldii* Kindb. Macoun Cat. Can. Pl. 6: 238) soit spécifiquement distinct du *H. arcuatum* Lindb., que offre dans l'Amerique du Nord des variations très intéressantes."

Kindberg's type of *Hypnum arcuatiforme* Kindb. Macoun, Cat. Can. Pl. 6: 238. 1892, has been examined. The leaves are channeled above and the capsules smooth except at base. A study of the European literature leads one to believe that the European plants of *H. arcuatum* are not regularly characterized by a plicate capsule. Dixon does not mention it, many continental authors also fail to mention this character. Limpricht says "schwach gefurcht" for the dry capsule. The smooth capsule is the only distinction between the two. The Kindberg type of *H. pseudo-drepanium* l. c. 240 is a form of *H. arcuatum demissum* with plicate leaves. Drummond's Musc. Am. S. States 150 as *H. cupressiforme corruscans* is also a form of *H. arcuatum*.

13. *HYPNUM PRATENSE* Koch, Brid. Bryol. Univ. 2: 769. 182 .

Hypnum amoenum Hook. in Drumm. Musc. Am. 196 in part.

Hypnum subflaccum C. M. & Kindb. Macoun, Cat. Can. Pl. 6: 240. 1892.

Hypnum pseudo-pratense Kindb. Macoun, Cat. Can. Pl. 6: 239. Type seen.

Entodon Macounii C. M. & Kindb. Macoun, Cat. Can. Pl. 6: 177.*

Closely related to *H. arcuatum*, from which it differs in its lax Plagiothecium-like habit, rarely pinnate branching; leaves often secund at branch tips but very slightly so elsewhere; base of leaves narrowed and rounded to the insertion; a few alar cells gradually enlarged but *not sharply differentiated or bordered by smaller quadrate cells*; leaves slightly concave, often nearly flat under the cover-glass. Capsules not plicate when dry and empty, rarely produced. Grades into *H. arcuatum* var. *demissum* but this has the abruptly enlarged and inflated alar cells bordered by the smaller cells. Spores in spring. Type locality European.

ILLUSTRATIONS:—Bry. Eur. pl. 611; Pl. 33.

EXSICCATI:—Drumm. l. c.; Sull. Musc. Allegh. 20; Austin Musc. Appal. 425; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 325.

Wet places in open swamps and meadows. Rare in Europe and apparently rare in America but widely distributed from arctic America to Pennsylvania, New Jersey, Colorado and Vancouver Island. *Plagiothecium brevipungens* Kindb. l. c. 215 from Ottawa, Canada, Macoun, June 2, 1898, no. 812 in my herbarium also is *Hypnum pratense*.

14. *HYPNUM HAMULOSUM* Bry. Eur. fasc. 57-61. pl. 590. 1854.

Hypnum chlorochroum Jur. (according to Mol. Bayern Laubm. 260. 1875).

Hypnum Breidleri Limpr. Laubm. 3: 493. 1899 (according to Moenkemeyer).

A very small alpine species growing in dense thick cushions; stems erect or ascending, irregularly branching as a rule, sometimes in thinner tufts almost regularly pinnate; cortical stem cells large, thin-walled and subhyaline; paraphyllia few and small, subulate to lanceolate; stem leaves ovate-lanceolate, concave more or less narrowed to insertion, rarely slightly decurrent, less than 1 mm. long, slenderly long-acuminate, strongly falcate-secund to subcircinate, entire or serrulate at apex; margins plane or somewhat recurved near the base; median leaf cells broadly linear-flexuose, about 6 μ wide, 7-12 : 1 : basal shorter and thicker-walled; often no differentiated alar cells, sometimes a line of two or three larger clear cells at extreme angles and rarely (more often in American plants) a very small group of small quadrate cells just inside these; costa double and short, sometimes reaching $\frac{1}{4}$ the length of leaf. Autoicous; capsules oblong-cylindric, more or less curved, inclined to horizontal, \pm 2 mm. long; annulus present; operculum conic; peristome perfect; spores in late summer. Type locality European Alps.

* Type not in Kindb. herbarium. Have examined Can. Musci. 436, quoted as type. All the *E. Macounii* in Kindberg herbarium is *Plagiothecium deplanatum*.

ILLUSTRATIONS:—Bry. Eur. l. c.; Pl. 35.

EXSICCATI:—Macoun. Can. Musci 352.

Several European localities are cited in the original description as well as specimens sent Schimper by Drummond from Rocky Mountains. Hector, Rocky Mts., Macoun, Can. Musc. 352; Dawson, Yukon Terr., Williams. Macoun's 874 in my collection, from Anticosti, is *Drepanocladus uncinatus*.

Some European authors give the leaves as 1.5 mm. long, but I have not been able to find any such. Limpricht says the leaf margins are recurved at base and I find them so in many cases.

Apparently frequent in the Rocky Mts. region of the northern U. S. and Canada north to Alaska, south to Utah.

15. HYPNUM BAMBERGERI Schimp. Syn. (Ed. 1) addend. 698. 1860.

Stereodon circularis Mitt. Journ. Linn. Soc. 8: 42. 1865.

Plants robust, in dense tufts or cushions, 3–8 cm. deep, dark brownish-green to golden-brown; stems more or less erect, usually with long erect simple divisions and a few short irregularly placed branches, but occasionally procumbent and nearly regularly pinnate; leaves close, strongly secund and circinate, 1.5–2 x 0.5–0.75 mm., from an oblong-ovate to oblong-lanceolate base gradually narrowed to a long slender channelled acumination which is flexuose when dry, concave, entire or sinuate above, not plicate; margins plane; costa short and double or lacking, one branch often longer; all leaf cells incrassate, the median linear-flexuose, 6–7 μ wide, 6–10 : 1; basal shorter, pitted, and colored, hexagonal to quadrate angular cells few, somewhat swollen but very thick-walled and strongly colored, obscure, forming a convex group. Dioicous; capsules oblong-cylindric, curved, with lid about 2.4 mm. long, annulus large; operculum conic; peristome normal; spores very rare, ripe in summer, not yet found in America. Type locality summit of the Stockhorn, Swiss Alps¹ alt. 6000 ft. Pl. 35.

A rare calcicolous arctic-alpine moss, resembling a small form of *Cratoneuron falcatum* in gross appearance.

Beechey Island and Wellington Channell (Lyal); Lake Maligne, Jasper National Park, British Columbia; Yukon; Little Pendulum Island and Hurry Inlet, East Greenland. The specimens collected at Bernard Harbor, N. W. Territory, by the Canadian Arctic Expedition seem doubtfully this species. According to Bryhn this was collected by the Amundsen expedition at Herschell Island and "Gjøhavn." The plants collected at Grant Land by the Peary expedition and determined by Bryhn as *H. Bambergeri* are not that species, at least the specimens in the herbarium of the New York Botanical Garden are not. Mr. Dixon has seen these plants and suggests that they may be a form of *Drepanocladus badius*.

16. HYPNUM FASTIGIATUM Brid. Bryol. Univ. 2: 620. 1827.

In rather thin closely interwoven mats; stems creeping, very slender; often stoloniferous at the ends; cortical cells not enlarged; paraphyllia present; branching irregularly pinnate; leaves densely imbricate, ovate-lanceolate, slenderly long-acuminate, not decurrent, 0.6–0.9 x 0.2–0.3, strongly falcate-secund, concave; margins plane, entire or obscurely denticulate above; median leaf cells about 5 μ wide, 6–10 : 1; basal shorter and subrectangular; at basal angles a considerable number of small quadrate cells; branch leaves much smaller, often ovate. Monoicous; seta about 1.5 cm. long; capsules cylindric, curved and more or less cernuous, sometimes nearly symmetric and erect; when dry and empty contracted under the mouth and striate at the neck, with the conic-apiculate operculum about 2 mm. long; annulus present; peristome typical; spores in early summer. Type locality, Austrian Alps.

ILLUSTRATIONS:—Bry. Eur. pl. 589; Pl. 34.

EXSICCATI:—Ren. & Card. Musc. Am. Sept. Exsic. 340.

An alpine calcicolous moss very rare in N. America. The no. 240 of Ren. & Card. is doubtfully this species, as the leaves are too short and broad (broadly ovate) and much more shortly acuminate than typical forms. Schimper in the Bry. Eur. states that he has received specimens from the Rocky Mts. sent by Drummond; Banff, Alberta, (Brinkman), *Pipestone Pass, 7300 ft., B. C. (Macoun) also Yoho Valley, B. C. It is distinguished from *H. pallescens* by its extremely small size and from *H. hamulosum* by the small cortical cells.

Although Brotherus describes the leaf margins as plane, they are slightly but clearly recurved in his *Bryotheca Fennica* 92a.

In the mountains of Colorado, near Tolland, at an altitude of 10,000 ft., I collected a few fragments of a moss with less slenderly acuminate, less falcate leaves, more rounded at base and with fewer quadrate alar cells than in *H. fastigiatum*. It corresponds well with Bry. Eur. pl. 590, *H. Sauteri*, but is too fragmentary for a decisive determination.

* In Kindberg herbarium as *H. subhamulosum*.

17. HYPNUM REPTILE Mx. Fl. Am. Bor. 315. 1803.

Raphidostegium subadnatum C. M. & Kindb. Macoun, Cat. Can. Pl. 6: 209. 1892.*

Plants small, slender, in thin closely interwoven mats, dark green, more or less regularly pinnate, but so interwoven that the branching is obscured; stems 2-5 cm. long, creeping; branches 4-6 mm. long; paraphyllia few, lanceolate, comparatively large; leaves close, somewhat narrowed to the insertion and slightly decurrent, *strongly falcate-secund*; stem leaves slenderly long-acuminate from an ovate base, 1 x 0.5 mm., concave, not plicate; margins plane or slightly revolute and serrulate to entire below, *strongly serrate above*; costa short and double or lacking; occasionally one branch longer and reaching nearly to the leaf middle; median leaf cells linear-rhomboidal to linear-flexuose, 6-7 μ wide, 6-10 : 1, basal shorter and broader and somewhat colored; *quadrate alar cells very numerous (10-20 marginal) and subopaque, much as in H. cupressiforme*; *angular inflated cells lacking*; branch leaves smaller, lanceolate, with fewer quadrate alar cells; *perichaetial leaves plicate*. *Monoicous*; seta 1-1.5 cm. long; capsules with lid 2.5-3 mm. long, subcylindric, somewhat curved and inclined, *shrinking most on the under side of the mouth, much as in Dicranella heteromalla*, so that the operculum is almost at right angles to the lower portion of the capsule; operculum conic, *short-rostrate*; annulus large; peristome perfect; *spores in midsummer*. Type locality Grandfather Mountains, N. Carolina.

ILLUSTRATIONS:—Bry. Eur. pl. 587; M. H. M. 357, f. 190.

EXSICCATI:—Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 322; Drumm. Musc. Am. 207 (as *H. cupressiforme* var.) Aust. Musc. Appal. 415; Grout, N. Am. Musc. Pl. 19, Musci Perfecti 3.

Common on bases of trees, stones and decaying wood in elevated regions, less frequent at lower levels. At about 2500-3000 ft. its place is taken in New England by *H. pallescens*. It ranges across the continent from Nova Scotia to Alaska, south to Arizona and N. Carolina in the mountains. The abundant and characteristic capsules, ripening in midsummer, make fruiting plants of this species easy to recognize, although the leaves vary a great deal in width and in slenderness of acumination. According to Cardot & Thériot *H. micro-reptile* Kindb. and *H. reptiliiforme* Kindb. are synonyms of this species. Paris makes *micro-reptile* a synonym of the next.

*18. HYPNUM PALLESCENS (Hedw.) Bry. Eur. fasc 57-61. pl. 586. 1854.

Leskea pallescens Hedw. Sp. Musc. 219. pl. 55, figs. 1-6. 1801.

Rhynchostegium Jamesii Sull. Icon. Musc. Suppl. 92. pl. 68. 1874.

Hypnum depressulum C. Muell. Flora 58: 91. 1875.

An alpine development of the preceding, growing on the bark of trees at high altitudes. It is less regularly pinnate; *leaves more slenderly acuminate*, more loosely arranged and less falcate-secund, less serrate, *with a smaller area of quadrate alar cells*; capsules about $\frac{1}{4}$ the length of those of *reptile*, nearly symmetric and erect, *not shrinking under the mouth when dry and empty*; spores in late summer. Type locality European.

ILLUSTRATIONS:—Bry. Eur. pl. 586; Sull. l. c.; Pl. 33.

EXSICCATI:—Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 478 (as *H. hamulosum* ?); Aust. Musc. Appal. 414; Grout, N. Am. Musc. Pl. 95.

Chiefly on the bark of coniferous trees and decaying wood, northern U. S. and Canada across the continent, south in the mountains to Tennessee.

H. pallescens can usually be distinguished at sight by the thinner mats of a more *silky appearance*, due to the slender, less closely imbricated leaves, branches often curved at the ends, and by the short symmetric capsules.

19. HYPNUM REVOLUTUM (Mitt.) Lindb. Hedwigia 7: 108. 1868.

Stereodon revolutus Mitt. Musc. Ind. Orient. 97. 1859.

Hypnum Heufleri Jur. Verh. K. K. Zool.-Bot. Ges. Wien, 1861: 431. 1861.

Stereodon plicatilis Mitt. Journ. Linn. Soc. 8: 40. 1865.

Hypnum Watsoni Lesq. & James Proc. Am. Acad. 14: 138. 1879. (According to Austin, Bull. Torr. Bot. Club. 7: 6. 1880, who had an authentic specimen for comparison.)

Plants either erect, densely tufted and irregularly branched or prostrate in thinner interwoven mats and more regularly pinnate, yellowish-or brownish-green; stems 3-5 cm. long, occasionally larger; cortical cells not enlarged; pseudo-paraphyllia in the axils of the branches and leaves; stem leaves crowded, falcate-secund, 1-2 x 0.5-0.8 mm., plicate-striate when dry, typically oblong-lanceolate and gradually tapering

* See Bryol. 5: 66. 1902.

from near the base to an acumination of varying length and slenderness, entire or sinuate on the upper margins, *always concave with margins strongly revolute in the lower 1/2 at least; quadrate alar cells numerous* (10-15 marginal); median cells rather short for the genus, 5-6 μ wide, 3-7 : 1, rarely reaching 10 : 1, thin-walled; basal shorter, thicker-walled and somewhat pitted; costa short and double or lacking, rarely reaching 1/2 length of leaf; branch leaves smaller, often sharply serrulate above even in European plants. Dioicous; seta 15-20 mm. long; capsule cylindric 2-3 x 0.75 mm., more or less curved, strongly contracted under the mouth when dry, often striate when old and with the mouth almost as oblique as in *H. reptile*; operculum conic; annulus of two or more rows of cells; peristome perfect; spores in summer. Type locality, mountains of Thibet.

ILLUSTRATIONS:—Braithw. Brit. Moss Fl. pl. 114; Husnot, Musc. Gall. pl. 116; Pl. 35.

EXSICCATI:—Grout, N. Am. Musc. Pl. 189, 364a & 367; R. & C. Musc. Am. Sept. Exsic. 398.

Common in the Rocky Mt. region at altitudes above 7000 ft. from Arizona, New Mexico and California to British Columbia and the Arctic; Black Hills, South Dakota; Greenland (Fl. Gr.). On bare exposed rocks, mostly non-calcareous. An exceedingly variable species whose variations seem to be due in large part to habitat conditions.

The larger regularly pinnate form with ovate-lanceolate to oblong-lanceolate leaves, gradually acuminate is known in Europe as var. *Molendoanum* (Schimp.) Lindb. The small form with less regular branching, smaller, narrower and non-plicate leaves is known as var. *pygmaeum* Mol. As identified by Cardot both forms were collected in Colorado by Dr. Jewett in the same mat and were issued together as N. Am. Musc. Pl. 364. *Hypnum filiforme* Kindb. Rev. Bryol. 22: 88. 1896 (type seen) is a very slender form with small, broadly ovate short-acuminate leaves scarcely or not at all plicate and with margins less recurved, sometimes almost plane.

The capsules as represented in N. Am. Musc. Pl. 367 are very much like those of *H. reptile*, but they as a rule are less curved, the mouth less oblique and the operculum scarcely apiculate.

Though the leaves may vary from broadly ovate and short-acuminate to much larger and slenderly oblong-lanceolate with a long slender acumination, the recurved to strongly revolute margins, the conspicuous triangular patch of quadrate alar cells (varying considerably in size) and the relatively short leaf cells are usually enough to make recognition fairly easy.

20. HYPNUM GEMINUM (Mitt.) Lesq. & James. Manual. 365. 1884.

Stereodon geminus Mitt. Journ. Linn. Soc. 8: 39. pl. 7. 1865.

The type is in the Mitten herbarium in the collections of the N. Y. Botanical Garden, but it is very fragmentary. It is a true *Stereodon* with no *Plagiothecium* affinity and Mitten's figures are most misleading. The branch leaves are lanceolate to ovate-lanceolate, acuminate, 0.6-0.7 mm. long, second to falcate-second, concave, entire entire throughout, but in other cases *entire above and serrate at base*. This and the usually strong double costa with one branch reaching nearly to the leaf middle, are its most striking characters. The median leaf cells are short-linear, about 6 μ wide, 6-8 : 1; at angles a small group (2-4 on the margin) of quadrate cells. According to Mitten the plants are monoicous; capsules ovoid-cylindric, suberect, gradually narrowed at the neck; peristome perfect, with two cilia. Type locality, Rocky Mts. alt. 6000-8000 ft., with *Plagiothecium pulchellum*.

It is evidently an arctic-alpine form, little collected and less known. It is easily distinct from any *Stereodon* known to the writer.

HYPNUM OBSOLETINERVE Kindb. Ottawa Nat. 23: 140. 1909.

Plants growing in dense thick cushions, very brittle, small, about the size of *H. fastigiatum*, irregularly divided and branching; branches very short; leaves more or less second; stem leaves lanceolate to ovate-lanceolate, reaching 1 mm. in length, gradually and slenderly acuminate, with acumination often filiform, entire or subserrulate at base, more or less concave with upper margins often incurved; costa simple, varying from almost nothing to fairly strong and reaching the middle of the leaf; median leaf cells oblong to oblong-linear, about 7 μ wide, 4-6 : 1; at basal angles a very small group of quadrate cells; branch leaves smaller, less slenderly acuminate, ovate to ovate-lanceolate, mostly ecostate; leaf cells shorter. "Dioicous," according to Kindberg.

On earth in swampy soil at Laggan, Alberta, Alt. 5,500 ft., June 28, 1904, no. 163. Type seen and studied.

This another obscure arctic-alpine plant of which more material is necessary to fully identify and relate. It reminds one of *H. geminum* except for the simple costa and filiform acumination. Kindberg placed it in *Campylium*. Mr. Dixon says of the type: "This is surely a *Campylium*. I have frequently seen it from Europe and Asia. It is, I feel fairly sure, a reduced form of *C. polygamum*."

Subgenus PTILIMUM Sull. Mosses U. S. 73. 1856.

21. HYPNUM CRISTA-CASTRENSIS L., Hedw. Sp. Musc. 287. pl. 76. figs. 1-4. 1801.

Plants robust, rigid, growing in large loose mats; bright yellow-green above, brownish below; central strand small consisting of small thick-walled cells; stems simple or sparingly divided, ascending to erect, 5-20 cm. long; *branching regularly complanate-pinnate and beautifully plumose with branches of equal length except at the triangular end of the frond where they gradually and evenly diminish like the pinnae of a fern*; paraphyllia numerous; *stems and branches hooked at the tips* by the falcate-secund leaves; stem leaves crowded, oblong-ovate, gradually long-acuminate, somewhat narrowed to the insertion and slightly decurrent, *strongly plicate*, $\pm 2.5 \times 1.1$ mm., strongly secund, hooked above, rather thin; distantly and sharply serrate above; branch leaves much narrower, less deeply plicate, less serrate, *circinate, usually curved toward the branch below in the plane of the frond*, about 1.8×0.4 mm.; costa lacking or short and double; median leaf cells linear-flexuose, about 6μ wide, 10-15 : 1, not papillose; basal shorter; alar broader, clear but often somewhat indistinct. Dioicous; seta 4-5 cm. long; capsule arcuate-cylindric, subhorizontal, light brown, reddish when old, with operculum about $3\frac{1}{2}$ mm. long, 1 mm. thick; operculum dome-shaped, apiculate; annulus narrow, difficult to demonstrate; peristome perfect, papillose, with 2-4 cilia; spores in autumn. Type locality European.

ILLUSTRATIONS:—Hedw. l. c.; Bry. Eur. pl. 599; Jennings, Mosses W. Pa. pl. 45; M. H. M. figs. 181 & 182; Mosses with H-lens (Ed. 3) plates 54, 55 & 56.

EXSICCATI:—Sull. Musc. Allegh. 22; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 318; Aust. Musc. Appal. 434; Grout, N. Am. Musc. Pl. 35 & 126.

On rocks, soil and decaying wood in cool forests. Common in the mountains, northern U. S. and Canada across the continent, south to North Carolina and Iowa, occasional at sea level as far south as Long Island, New York. When fully developed, one of our most beautiful and striking species. Near the summit of Mt. Washington and probably in similar situations elsewhere is a reduced form, darker colored, with very crowded branches so that the leaves of one branch touch the next below.

Subgenus CTENIDIUM Schimp. Syn. (Ed. 1) 631. 1860.

Plants mostly calcicolous, soft; stems with central strand, mostly prostrate; branching mostly regularly pinnate; leaves falcate-secund and *decurrent*, more or less plicate, *cordate-auriculate* (in our species) at base and rapidly narrowed to a long slender acumination; quadrate to rectangular alar cells numerous, not inflated, usually small but not thick-walled or colored.

22. HYPNUM MOLLUSCUM Hedw. Sp. Musc. 289. 1801.

Plants in dense, usually thin, *closely interwoven mats, glossy golden green to brownish below*, exceedingly variable in branching, robustness and curvature of leaves, *typically regularly pinnate and plumose*, occasionally fastigiate in crowded erect forms; stems reaching 10 cm. in length, prostrate to ascending; leaves imbricate when dry, *falcate-secund, plicate, usually somewhat undulate or contorted toward the apex*; stem leaves *slenderly long-acuminate from an auriculate cordate-triangular base, decurrent*, $1.5-2.5 \times 0.9-1.2$ mm.; margins *plane, strongly serrate to base*; costa *very short and double or lacking*; median leaf cells linear, about 7μ wide, 8-12 : 1, somewhat papillose at back by projecting cell angles; cells becoming shorter and broader toward the leaf base, the *auricular irregularly quadrate-rhomboidal, not inflated or colored*; branch leaves much smaller, lanceolate, *scarcely auriculate or cordate*, usually more sharply serrate. Dioicous; seta 1-2 cm. long; capsule with operculum about 2.2 mm. long by a little less than 1 mm. thick, oblong to ovoid, unsymmetric, cernuous; operculum conic-acuminate; annulus large, peristome perfect; calyptra somewhat hairy when young; spores in summer. Type locality European.

ILLUSTRATIONS:—Bry. Eur. pl. 598; Jennings, Mosses W. Pa. pl. 42; M. H. M. 350.

EXSICCATI:—Sull. Musc. Allegh. 21; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 319, (Ed. 2) 471; Aust. Musc. Appal. 433; Grout, N. Am. Musc. Pl. 124 & 124a.

On moist shaded rocks, soil and bases of trees, Newfoundland to the Rocky Mts., south to Georgia and Oklahoma, ranging from sea level in Long Island, New York, to 3000 ft. in the Carolina Mts.

In leaf structure this species strongly suggests *Hylocomium* but it is without the abundant multifid paraphyllia of that genus.

Exceedingly variable in size and habit, sometimes as fine and slender as *Drepanocladus plumulosus* (the var. *fastigiatum* Bosw.), again robust and dark colored (a form close to if not exactly representing var. *condensatum* Schimp.). I have seen no American forms as robust and red as the European var. *robustum* Boul., an alpine form which in color and size reminds one of *Drepanocladus revolvens*. From Ashville, N. Carolina (com. Dr. P. O. Schallert) comes a rather robust form with leaves not at all falcate and rarely

secund even at the tips of stems and branches (forma *orthophyllum* n. f.). In all these forms, however, the characteristic triangular cordate-auriculate, sharply serrate stem leaves, with characteristic cell structure as described, make it easy to recognize under the microscope. The European *molluscum* is even more widely variable than the American, no less than nine varieties being listed by Limpricht (Laubm. 3: 447-451).

Var. *MOLLUSCOIDES* n. comb.

Hypnum molluscoides Kindb. Rev. Bryol. 22: 85. 1895.

An arctic-alpine form with nearly entire stem leaves. All leaves more slenderly acuminate. Type from Bay Bull Arm, Newfoundland, Waghorne. Type seen. Also collected at several Labrador localities and from Cape Breton Island, Nova Scotia. Apparently common in Newfoundland as Waghorne collected it many times. Possibly a good species.

23. *HYPNUM PROCERRIMUM* Mol. Flora 49: 458. 1866.

More robust and rigid than the last, golden- to brownish-green; fronds reaching 7 cm. or more in length by 2 cm. wide; branching regularly pinnate, branches becoming progressively shorter toward the stem end as in *Hypnum Crista-castrensis*; stem leaves slightly decurrent, strongly falcate-secund, much as in the last but entire and not papillose at back, reaching 4 mm. in length. Sporophytes unknown.

ILLUSTRATIONS:—Braithw. Brit. Moss Fl. 3: pl. 112D; Dixon & Jam. Handb. Brit. Mosses (Ed. 3) pl. 59J; Pl. 35.

On damp rocks in arctic regions of N. America to 76° 30' according to Brotherus. No American specimens seen.

Specimens from the arctic regions are frequently depauperate and less regularly pinnate at the ends of the stems. Perfect plants are as plumose as *H. Crista-castrensis* but much larger.

2. *BROTHERELLA* Loeske, Stud. 175. 1910.

Pseudo-raphidostegium Broth. (subgenus of *Stereodon*) Engler & Prantl, Musci (Ed. 1) 1073. 1908.

Plants slender and creeping; leaves secund, usually falcate-secund, ovate-lanceolate to lanceolate, slenderly acuminate, serrate, especially above, often with margins recurved below; leaf cells long-rhomboidal to linear, several alar cells inflated and hyaline, or colored when old; costa faint, double or lacking. Capsules oblong to ovoid, erect and symmetric to curved and cernuous; annulus lacking; operculum long-rostrate; exothelial cells not collenchymatous; peristome with cilia (except *tenuirostris*).

Differs from *Hypnum* in the long-rostrate operculum and from *Sematophyllum* in the non-collenchymatous exothelial cell walls and the strongly serrate leaves.

Key.

1. Inflated alar cells relatively numerous, often reaching nearly to middle of leaf base; plants occurring west of Rocky Mts. 4. *Roellii*.
- Inflated alar cells less numerous; plants occurring east of Rocky Mts. 2.
2. Plants very slender and little complanate; capsules erect and symmetric; peristome with cilia rudimentary or wanting 3. *tenuirostris*.
- Plants distinctly complanate-foliate, with strongly falcate leaves; capsules more or less unsymmetric and inclined; peristome perfect 3.
3. Plants of plains and low elevations, light to yellowish-green, shining; operculum $\frac{1}{2}$ the length of urn 1. *recurvans*.
- Plants usually darker and less shining, growing in cool elevated woods; operculum nearly or quite as long as urn 2. *delicatula*.

Mrs. Britton states, Bryol. 5: 66, that *Raphidostegium subdemissum* Kindb. was described from sterile Alaskan specimens that do not belong to *Sematophyllum* in which she included this genus in part.

BROTHERELLA RECURVANS (Mx.) Fleisch. in Nova Guinea 12: 120. 1914.

Leskea recurvans Mx. Fl. Bor. Am. 2: 311. 1803.

Leskea squarrosa Mx. l. c.

Leskea arcuata Brid. Sp. Musc. Suppl. 2: 64. 1812.

Hypnum recurvans Schwaegr. Suppl. 1²: 289. 1816.

Raphidostegium recurvans (Schwaegr.) Bry. Eur., Sull. & Lesq. Musc. Bor. Am. 301. 1856.

Plants in wide closely interwoven mats, *yellowish-green, very glossy*; branching irregularly pinnate; leaves *strongly falcate-secund* and turned downwards, except in slender or depauperate forms; stem leaves ovate-lanceolate, slenderly long-acuminate, not decurrent, somewhat concave, about 1.2–1.5 mm. long; margins somewhat reflexed below, sharply serrate above; costa lacking or short and double; median leaf cells linear-flexuose, $\pm 90 \mu$ long, basal broader and shorter, usually somewhat colored; at the extreme basal angles are 4–8 very much enlarged and inflated cells ("bubble cells"), which may be hyaline or colored, 3–4 above these on the margins are smaller and subquadrate; perichaetial leaves strongly spinose-dentate above, not plicate. Dioicous; seta 1–2 cm. long; *capsules oblong-ovoid, curved and oblique*, the urn being 1.5–2 mm. long, the *operculum, which is long-rostrate, is about $\frac{1}{2}$ the length of the urn*; spores in late autumn. Type locality, Mts. of N. Carolina.

EXSICCATI:—Sull. Musc. Allegh. 18; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 301, 301b, (Ed. 2) 446; Aust. Musc. Appal. 340 & 341 (a depauperate form simulating *B. delicatula*); Drumm. Musc. 196 (in part only); Grout, N. Am. Musc. Pl. 1, Musci Perfecti 150.

ILLUSTRATIONS:—Sull. Icones Musc. pl. 111; Bryol. 6: pl. 1: Pl. 35.

Mrs. Britton (Bryol. 6: 2) says an annulus is present and figures it in pl. 1, f. 16, but I have never been able to demonstrate it.

Common on decayed wood and soil at base of trees in moist shaded places, more abundant in somewhat elevated regions, varying a great deal in robustness and general habit and at higher elevations (2500 ft. and above) passing gradually into the next by all degrees of intergradation. It ranges from Newfoundland to Manitoba, Minnesota, Wisconsin, south in the Alleghanies to Georgia; replaced in the Rocky Mts. and the West Coast by *B. Roellii*.

2. BROTHERELLA DELICATULA (James) Fleisch.

Rhynchostegium delicatulum James, Sull. Icones Musc. Suppl. 93. pl. 69. 1874.

Hypnum laxepatulum Lesq. & James, Man. 358. 1884.

Raphidostegium Whitei Kindb. Bryin. Eur. & Am. 1: 63. 1897.

Sematophyllum delicatulum (James) E. G. B. Bryol. 5: 66. 1902. (Which see for complete synonymy.)

A high-altitude subspecies of the preceding, a smaller, darker-colored plant, growing in thin appressed mats, scarcely glossy, with the leaves less constantly falcate-secund. Seta and capsules shorter, the latter more nearly symmetric and more erect; the slenderly rostrate *operculum as long as the urn*, together being about 2.5–3 mm. long.; *cilia present in the type*.

ILLUSTRATIONS:—Sull. l. c.; M. H. M. pl. 81.

EXSICCATI:—Sull. Musc. Allegh. 17 (as *Hypnum recurvans* var.); Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 447 (as *H. recurvans*, var.); Grout, N. Am. Musc. Pl. 112 & 308.

On rotten wood, soil or at base of trees at altitudes of 2,500 ft. or over in New England, and corresponding altitudes elsewhere. Hudson Bay to Manitoba and from New England to Alabama in the East, probably in eastern Canada.

3. BROTHERELLA TENUIROSTRIS (Schimp.) Broth. Engler & Prantl, Musci (Ed. 2) 2: 425. 1925.

Leskea tenuirostris (Br. & Sch.) Sull. Mosses U. S. 668. 1848.

Hypnum cylindricarpum C. Muell. Syn. 2: 308. 1850.

Plants in thin intertangled mats, dark to yellowish green; stems slender, creeping, 3–4 cm. long, their cuticular cells rather large, reaching 15μ in width; branching pinnate, sometimes regularly so, but usually obscured by its closely interwoven habit; branches slender, short, 5–10 mm. long; leaves slightly secund, with apices turned ventrally as in the other species but scarcely complanate or two-ranked, erect-spreading when moist, loosely appressed-imbricate when dry; stem and branch leaves little different, but branch leaves smaller and sometimes more shortly acuminate, all oblong-lanceolate, gradually and slenderly acuminate, reaching 1.2 mm. in length, usually shorter, about 4 : 1; margin usually reflexed below, with few exceptions sharply serrate above; costa lacking, rarely showing short double traces; median leaf cells broadly linear, 8μ wide, 7–10 : 1; basal cells somewhat shorter, a small group of angular cells moderately inflated, hyaline or slightly colored, above these on the margins a few smaller subquadrate cells; perichaetial leaves erect, loosely imbricate, the inner gradually narrowed to a slender, coarsely serrate acumination. Dioicous; seta about 1 cm. long; capsule erect and symmetric, with operculum 2 mm. long; operculum rostrate, $\frac{1}{2}$ the length of urn; annulus lacking; cilia of peristome rudimentary or lacking; spores in early spring. Type Sull. Musc. Allegh. 60.

ILLUSTRATIONS:—Sull. Icon. Musc. *pl.* 109; *Pl.* 35.

EXSICCATI:—Sull. Musc. Allegh. 60 (as *Leskea polyantha*); Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 300 (Ed. 2) 445 in part; Aust. Musc. Appal. 342 & 343.

Decayed wood, bases of trees and moist rocks. Long Island, New York; New Jersey, Pennsylvania, Ohio, Indiana; south to N. Carolina and Georgia.

I doubt the identity of the Newfoundland, Labrador and New Brunswick specimens, as all the Macoun collections at Ottawa are something else.

4. BROTHERELLA ROELLII (R. & C.) Fleisch.*

Raphidostegium Roellii R. & C. Bot. Centralbl. 44: 423. 1890.

Sematophyllum Roellii (R. & C.) E. G. B. Bryol. 5: 66. 1902.

Hypnum Roellii Macoun, Can. Musci 444.

Plants slender, densely cespitose, shining yellow-green, with cuticular cells reaching 15 μ in width; stems reaching 2–3 cm. in length, subpinnately branching; branches unequal, sometimes flagelliferous at end; leaves *slightly to strongly secund, sometimes almost erect, again falcate*, oblong-lanceolate, decurrent, slenderly acuminate, reaching 1 mm. in length; margins plane or recurved below, serrulate above; costa short and double, faint or nearly lacking; median leaf cells linear-flexuose, about 7 μ wide, 8–10 : 1; *inflated alar cells relatively large, the outer reaching 18 x 60 μ* , mostly in a row reaching nearly to the middle of the leaf base; inner perichaetial leaves much like large stem leaves. Monoicous; capsule oblong, subsymmetric, somewhat inclined; urn about 1.7 x 0.5 mm.; *operculum long rostrate (3/4 to once the length of the urn)* straight or bent at base; calyptra twice the length of operculum, only slightly split at base on one side much as in *B. delicatula*; peristome perfect; annulus lacking; spores in winter. Type from Enumclaw, Washington, Roell, 1888.

EXSICCATI:—Macoun. Can. Musci 444; Allen, Mosses Cascade Mts. 143; Grout, N. Am. Musc. Pl. 378.

On rotten logs in woods, British Columbia, Washington; probably with a wider range west of the Rocky Mts.

3. HETEROPHYLLUM (Schimp.) Kindb. Check List Eur. & Am. Mosses 72. 1894.

(From Can. Rec. Sci. Jan. 1894.)

Heterophyllum, subgenus of *Hypnum* Schimp. Syn. 629. 1860.

Plants robust; stems mostly prostrate; paraphyllia multiform; leaves erect-open to somewhat secund, scarcely falcate, \pm concave, more or less long-acuminate; leaf cells narrowly linear, broader and yellowish at base; angular cells quadrate to rectangular and somewhat inflated; costa short and double or lacking. Monoicous; capsules often nearly erect and symmetric, annulus present; peristome perfect. Growing mainly on decaying wood.

Though following Brotherus in maintaining *Heterophyllum* as a genus, the author's private opinion is that it would better remain as a subgenus of *Hypnum*, though the gross appearance of our common *H. Haldanianum* is quite different from the general run of forms with falcate-sekund or circinate leaves. Type species, *H. nemorosum*.

KEY.

- | | |
|---|-------------------------|
| Leaves entire, none secund..... | 1. <i>Haldanianum</i> . |
| Leaves serrate; branch leaves sometimes secund..... | 2. <i>nemosum</i> . |

1. HETEROPHYLLUM HALDANIANUM (Grev.) Kindb. l. c.

Hypnum Haldanianum Grev. Ann. Lyc. of New York 1: 275, *pl.* 23. 1825.

†*Hypnum flaccum* C. M. & Kindb.; Macoun, Cat. Can. Pl. 6: 240. 1892.

Plants in loose wide mats, usually dark or brownish green, with the habit of *Brachythecium oxycladon*; stems 3–8 cm. long, creeping, irregularly branching; *paraphyllia large multiform, ovate, lanceolate and palmate*; leaves on the ascending stems and branches *loosely and nearly evenly imbricate*; stem leaves not decurrent, broadly ovate-lanceolate to oblong-ovate, 1.5–2 x 0.6–0.9 mm., rather rapidly narrowed to a short acumination, very concave; margins plane and entire; median cells about 6 μ wide, 12–18 : 1; basal shorter and broader;

* Citation from Engler & Prantl l. c. 424.

area of enlarged and inflated alar cells large (3-5 on the margin) forming distinct auricles bordered above by a line of smaller subopaque quadrate cells. Seta 1-2 cm. long, red; capsules long-cylindric, with lid 3-3.5 mm. long, suberect or inclined, somewhat curved; operculum short-rostrate; spores in late autumn or winter. Type locality near Moose Factory, Canada, J. Haldane.

ILLUSTRATIONS:—Bry. Eur. *pl.* 92; Jennings, Mosses W. Pa. *pl.* 46; M. H. M. 358. *f.* 191.

EXSICCATI:—Drumm. Musc. Am. 180, S. States 114; Sull. Musc. Allegh. 14; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 324, (Ed. 2) 482; Aust. Musc. Appal. 430, 431 & 432; Grout N. Am. Musc. Pl. 47 & 47a and Musci Perfecti 37; Macoun, Can. Musci 355.

Common on soil, humus and especially rotting wood in moist shaded places; "Nova Scotia to Montana and south to the Gulf States" (Jennings).

2. HETEROPHYLLUM NEMOROSUM (Koch) Kindb. l. c.

Hypnum nemorosum Koch in Brid. Bryol. Univ. 2: 422. 1827.

Hypnum subrectifolium Sull. Musc. Allegh. 15. 1846.

Plants somewhat more robust than *H. Haldanianum*, growing in wide loose mats, bright to pale green; stems 5-10 cm. long, more or less regularly pinnate with branches of unequal length; central strand lacking; paraphyllia in the branch axils, multiform; leaves erect-spreading when moist, more appressed when dry; stem leaves ovate to oblong-ovate, somewhat concave, narrowed above to a long lanceolate-subulate acumination (which is spinose-serrate and often flexuose) 2-2.5 mm. x 0.7-1 mm., slightly or not at all decurrent; margin plane or slightly reflexed below; costa short and double or lacking; median leaf cells linear, about 6 μ wide, 5-7 : 1; basal shorter and broader, incrassate, pitted and colored; at basal angles a group (3-5 on the margin) of quadrate to short-rectangular inflated, hyaline or colored cells, which are thick-walled; branch leaves often slightly secund toward the branch tips, smaller and narrower than the stem leaves, at the branch middle 1.2-1.5 mm. long. Seta \pm 2 cm. long, dark red to purplish; capsule, oblong-cylindric, curved, nearly erect to cernuous, red-brown, with operculum 3-3.5 mm. long, little contracted under the mouth when dry and empty; operculum conic-apiculate; spores in autumn. Type locality European (Rheinfalz).

ILLUSTRATIONS:—Bry. Eur. *pl.* 593; *Pl.* 34.

EXSICCATI:—Sull. Musc. Allegh. l. c.; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 325; (Ed. 2) 483 Grout, N. Am. Musc. Pl. 310, Musci Perfecti 192.

On decaying wood in mountain woods in the southern Appalachian Mts., south to Georgia, north to Virginia.

4. SEMATOPHYLLUM Mitt. Jour. Linn. Soc. 8: 5. 1865.

Rhynchostegium, subgenus *Raphidostegium* Bry. Eur. fasc. 49-51. 1852.

Plants mostly slender; branching irregular to subpinnate, branches spreading to erect, often curved, somewhat julaceous; leaves symmetric and equally spreading to somewhat narrowed to the insertion, not decurrent, ovate to oblong-ovate or oblong-elliptic, concave, not plicate, with margins entire or nearly so and strongly reflexed in most cases; costa lacking or short and double; leaf cells linear-flexuose to fusiform; basal oblong to rectangular, often colored; apical rhombic to oblong; at basal angles 3-8 large inflated, pellucid, hyaline or colored cells, very conspicuous. Monoicous in all our species; capsules small, oblong-ovoid, erect and symmetric to more or less unsymmetric and inclined; operculum rostrate; peristome usually perfect; cell walls of the exothecium plainly collenchymatous in all our species. The leaves described in specific descriptions are from the middle of well developed branches.

KEY.

- | | |
|---|--------------------------|
| 1. Plants growing on bark of trees or decaying wood; capsules erect and symmetric or nearly so..... | 2. |
| Plants growing on rocks; capsules more or less inclined and unsymmetric..... | 3. |
| 2. Median leaf cells linear-fusiform, 8-12 : 1..... | 1. <i>adnatum</i> . |
| Median leaf cells fusiform-rhomboidal, 3-7 : 1..... | 3. <i>caespitosum</i> . |
| 3. Perichaetial leaves serrulate..... | 2. <i>Smallii</i> . |
| Perichaetial leaves entire..... | 4. |
| 4. Plants robust; leaves 2-2.5 mm. long..... | 5. <i>marylandicum</i> . |
| Plants more slender; leaves 1.5 mm. long, or less..... | 4. <i>carolinianum</i> . |

1. SEMATOPHYLLUM ADNATUM (Mx.) E. G. B. Bryol. 5: 65. 1902.

Leskea adnata Mx. Flor. Bor. Am. 2: 311. 1803.

Hypnum microcarpum C. Muell. Syn. Musc. 2: 326. 1851; Sull. Icon. Musc. 175. pl. 110. 1864.

Plants in rather small thin mats or patches, green to golden-green; stems prostrate, sending up numerous suberect curved branches; leaves rather closely imbricate when dry, *narrowly oblong-lanceolate, gradually acuminate*, ± 1 mm. long; margins broadly reflexed, entire or nearly so, somewhat secund, especially at the branch tips; costa lacking or nearly so; median leaf-cells linear-fusiform, averaging about 6μ wide somewhat flexuose, about 8-12 : 1; basal shorter, often colored; at basal angles a row of 3-4 inflated cells along the insertion, above these a small group (3-4 along the margin) of smaller quadrate to rectangular cells; perichaetial leaves entire or somewhat sinuate at apex. Seta 5-10 mm. long, capsule chestnut colored, about 1-1.3 mm. long, oblong to oblong-ovoid, erect and symmetric or nearly so; constricted below the mouth when dry and empty; annulus lacking; operculum rostrate, nearly as long as the urn; peristome perfect with cilia short and single; spores in autumn. (See remarks M. H. M. p. 361.)

ILLUSTRATIONS:—Sull. l. c.; M. H. M. pl. 82.

EXSICCATI:—Drumm. Musc. Am. 107 (as *Hypnum crassiusculum*); Sull. Musc. Allegh. 65 & 66 (as *Leskea*);—Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 299, (Ed. 2) 443. Grout, N. Am. Musc. Pl. 255 & Musci Perfecti 68.

On bark of trees, usually on living trees, Pennsylvania, New Jersey and Rhode Island, and south to the Gulf, west to Texas. Common in the Southern States.

2. SEMATOPHYLLUM SMALLII Williams, Bryol. 23: 76. 1920. pl. 6.

Plants in thin mats; stems mostly 5-6 mm. long, bearing few branches and radicles; stem leaves nearly straight, widely spreading, more or less complanate or slightly secund, mostly 0.8-1 mm. long, ovate-lanceolate, acute to short-acuminate, entire and ecostate; leaf cells elongate-rhomboidal to more or less linear, *the median mostly 5-6 μ wide by 25-40 μ long*, the alar yellowish, enlarged and inflated; perichaetial leaves variable in length, the longer a little exceeding those of the stem, *more or less serrulate with spreading, sometimes recurved teeth below the acumination* and usually abruptly narrowed to an acute, slightly serrulate acumination about $\frac{1}{2}$ the entire length of the leaf. Autoicous, a male flower often at or near the base of the perichaetium; seta 6-8 mm. long; capsule urn about 0.6 mm. long, inclined or nodding, somewhat obovate, contracted under the mouth when dry and empty; median exothecial cells nearly square to short rectangular, with walls slightly thickened at the angles; annulus lacking; operculum long-rostrate, nearly as long as the urn; peristome perfect with cilia single, inner peristome from a basal membrane about $\frac{1}{2}$ the height of the teeth, *which are narrowly furrowed along the median line*; spores late spring to early summer. Type locality, Goodburn Hammock, Dade Co., Florida.

Type in herb. New York Botanical Garden, collected by J. K. Small and C. A. Mosier, June 1915, no. 6242. Also collected in Royal Palm Hammock by Dr. Small, Jan. 1, 1916, no. 7153.

This species is scarcely as large as *S. adnatum* from which it is distinguished by its serrulate perichaetial leaves and furrowed peristome teeth, also its less slenderly pointed leaves and shorter leaf cells. (The above description is compiled with little change from the original description.)

ILLUSTRATIONS:—Bryol. l. c. pl. 6; Pl. 36.

3. SEMATOPHYLLUM CAESPITOSUM (Sw., Hedw.) Mitt. Jour. Linn. Soc. 12: 479. 1869.

Hypnum caespitosum Sw. Prod. Fl. Ind. Occ. 3: 1807. 1795.

Leskea caespitosa Hedw. Sp. Musc. 233. 1801. pl. 49, f. 1-5.

Hypnum Kegelianum var. *tenue* C. Muell. Syn. 2: 325. 1851.

Sematophyllum subpinnatum (Brid.) E. G. B. Bryol. 22: 53. 1919.

Leskia subpinnata Brid. Bryol. Univ. 2: 287. 1827.

Raphidostegium Kegelianum (C. Muell.) Jaeger & Sauerb. var. *floridanum* R. & C. Bot. Gaz. 15: 61. 1890.

Plants in rather loose patches, dark to yellowish green; stems prostrate, 2-4 cm. long, irregularly branching, with numerous short erect or curved branches; leaves close, more or less secund, ovate to oblong-ovate, acute to broadly short-acuminate, reaching 1 mm. in length, usually shorter, entire, concave, with margins slightly recurved, ecostate or nearly so, rather gradually narrowed to the non-decurrent insertion; median leaf cells fusiform-rhomboidal, about 7μ wide, 3-7 : 1; apical shorter, rhomboid-elliptical; basal also shorter, rectangular and colored, a single row of 3-4 cells along the insertion at the basal angles some-

what larger and slightly inflated, above these a narrowly triangular patch of quadrate alar cells (6 or more along the margin); inner perichaetial leaves broadly ovate, short-acuminate, entire. Seta short, about 5 mm. long; capsules oblong-ovoid, erect and symmetric or nearly so; urn 1.2–1.5 mm. long; operculum rostrate, fully $\frac{1}{2}$ the length of the urn; annulus lacking; peristome perfect except for the lack of cilia; spores in winter. Type locality, West Indies.

ILLUSTRATION:—*Pl.* 36.

EXSICCATI:—Grout, N. Am. Musc. Pl. 273.

On bark of trees and decaying logs, Florida, rare.

Rather larger and coarser than *S. adnatum*, with broader leaves and shorter leaf cells; beak of operculum shorter.

The synonymy of this species is much involved and a thorough study of the types is needed to clear it up. Hedwig's figures of *Leskea caespitosa* do not match the Florida plant as Mrs. Britton and I know it, as the figures of the leaves are too slender at apex.

Brotherus, in the second edition of Engler and Prantl, says that the species is "formenreich" and apparently includes the plants from Louisiana collected by Langlois, which have been identified by Cardot as *S. Kegelianum*. These are rather more slender and a dirty green as if inundated at times.

4. SEMATOPHYLLUM CAROLINIANUM (C. Muell.) E. G. B. l. c. 66.

Hypnum carolinianum C. Muell. Syn. Musc. 2: 327. 1851.

Raphidostegium carolinianum (C. Muell.) Jaeger & Sauerb. St. Gall. Nat. Gesell. 1876-77: 401. 1877.

Hypnum demissum Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 298, (Ed. 2) 441.

Plants larger than the last, darker green, dirty green below, growing on wet rocks; stems 2–3 cm. long prostrate, irregularly branched; branches less erect often not curved; leaves ovate to oblong-ovate, contracted to the insertion, strongly concave with reflexed margins, acute or very short-acuminate, scarcely secund, 1–1.3 mm. long; alar cells much as in *adnatum*; median cells shorter, about 7 μ wide, 6–8 : 1, linear-fusiform; apical shorter, 2–3 : 1; basal shorter, subrectangular and colored, a small group (2–3 along the margin and base) enlarged and inflated, bordering these a few smaller subquadrate cells; perichaetial leaves more slenderly acuminate, entire, the inner larger than the other leaves. Capsules inclined, more or less curved and unsymmetric, strongly contracted under the mouth when dry and empty, about the same size as in *adnata* or a trifle larger; operculum a little shorter than the urn; peristome perfect, with cilia 1 or 2; spores in summer.

Type locality, Grandfather Mt., N. Carolina, Sull. Musc. Allegh. 48.

ILLUSTRATIONS:—Jennings, Mosses W. Pennsylvania pl. 48; *Pl.* 36.

EXSICCATI:—Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 298 (as *Hypnum demissum*) and 298b, a robust form approaching *S. marylandicum*, (Ed. 2) 440 & 441; Grout, N. Am. Musc. Pl. 302 & 307. Aust. Musc. Appal. 338 (as *H. demissum*).

Eastern North America from southern Canada to Georgia. Apparently common in the South Atlantic states.

Var. ADMIXTUM (Sull.) Grout, M. H. M. 363. 1910. Growing on stones but in drier situations than the typical form; plants lighter green; branches shorter, more erect and more curved at the ends when dry; leaves more closely imbricated when dry, smaller and usually narrower.

In dry situations this variety resembles *S. adnata* in appearance except for the curved cernuous capsules.

EXSICCATI:—Aust. Musc. Appal. 339; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 299 b, (Ed. 2) 444.

Massachusetts to Florida, apparently more common near the coast; Indiana, Welch.

Sterile it is difficult to distinguish from *adnatum*, but its capsules when soaked out are always inclined and unsymmetric and the cilia are better developed.

Musc. Bor. Am. (Ed. 1) 298 b is a form of *carolinianum* found in the northern part of its range that varies in the direction of *marylandicum* in size and cell structure.

5. SEMATOPHYLLUM MARYLANDICUM (C. Muell.) E. G. B. Bryol. l. c.

Hypnum marylandicum C. Muell. Syn. Musc. 2: 328. 1851.

Raphidostegium marylandicum Jaeger & Sauerb. l. c. 388.

Hypnum demissum var. *marylandicum* Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 298c. 1856.

Plants dark green, in wide loosely interwoven mats, much larger than any of our other species; stems 5–10 cm. long, resembling *Brachythecium plumosum* in gross appearance and *Hygrohypnum ochraceum* in leaf characters; leaves occasionally somewhat secund, especially at stem and branch tips, oblong-ovate, acute or with a very broad and short acumination, 1.5–2 mm. long, 0.6 to nearly 1 mm. wide, very concave, with margin entire and often not at all reflexed; median leaf cells linear-flexuose, about 7 μ wide, 8–12 : 1;

basal shorter, incrassate and colored; inflated alar cells 2-6, often thick-walled, bordered above by small cells; *apical shorter* 2-3 : 1, oblong to rhomboidal. Sporophytes very small for the size of the plants, little different from the last; spores apparently in spring.

Type locality "Backbone Mt., Maryland, Sull. Musci Allegh. 49" (as *Hypnum demissum* var.).

The leaf outline and alar cells of *S. carolinianum* are very little different from those of *marylandicum* but are on a much smaller scale.

EXSICCATI:—Sull. & Lesq. l. c. and (Ed. 2) 442; Aust. Musc. Appal. Suppl. 541; Grout, N. Am. Musc. Pl. 201 & 324.

On stones and ledges in and near cold brooks, mainly in the mountains; White Mts. of New Hampshire to Georgia; frequent in the mountains of the southern part of its range.

S. marylandicum and *S. carolinianum* appear to grade into each other; the size and length of leaf cells are the surest distinctive characters.

Easily confused with *Hygrohypnum eugyrium* when sterile; *eugyrium* has traces of a double costa and serrations in many of its leaves and the alar cells are thinner-walled at the extreme angles.

5. HOMOMALLIUM (Schimp.) Loeske, Hedwigia 46: 314. 1907.

Hypnum subgenus *Homomalium* Schimp. Syn. (Ed. 1) 616. 1860.

Stems usually creeping and attached firmly to the substratum by rhizoids; branches short, erect or arched, equally spreading or occasionally somewhat secund at stem and branch tips; leaf margins plane and entire or slightly denticulate near apex; costa short and double or lacking; leaf cells prosenchymatous, often linear, not papillose in our species; smaller quadrate alar cells numerous. Capsules cernuous to horizontal; ovoid to oblong, cylindric, unsymmetric, strongly curved and contracted under the mouth when dry and empty; peristome perfect with 2-3 well-developed cilia; annulus present. Type species *H. incurvatum*.

Distinguished from *Heterophyllum* by the more slender habit and shorter more curved capsules and shorter leaf-cells. From *Hypnum* by the less secund leaves. Closely related to *Pylaisia* but differing in the cernuous unsymmetric capsules with a perfect peristome, also in the leaves rarely secund in most species.

KEY.

- | | |
|--|-----------------------|
| 1. Leaves, at least the terminal, somewhat secund..... | 2. |
| Leaves equally spreading, not at all secund..... | 1. <i>adnatum</i> . |
| 2. Arctic-alpine, doubtfully North American..... | <i>incurvatum</i> |
| Subtropical, found only in Arizona & New Mexico..... | 2. <i>mexicanum</i> . |

1. HOMOMALLIUM ADNATUM (Hedw.) Broth. Engler & Prantl, Musci (Ed. 1) 2: 1027. 1908.

Hypnum adnatum Hedw. Sp. Musc. 248. pl. 64, f. 5-10. 1801.

Amblystegium adnatum (Hedw.) Aust. Musc. Appal. 370. 1870.

Amblystegiella adnata (Hedw.) Nichols, Bryol. 11: 5. 1908.

Plants in thin closely adherent patches, dark green, sometimes light green to yellowish-green; stems slender, prostrate, freely but rather irregularly branching; branches short, about 2.5 mm. long, erect; leaves crowded, erect-spreading when moist, loosely appressed when dry, ovate to oblong-ovate, abruptly and broadly short-acuminate, concave, very entire (with rare exceptions), \pm 0.8 mm. long and less than half as broad; costa short and double, rarely single, often wanting; median leaf-cells hexagonal-linear, averaging $6.5 \times 4.3 \mu$; *apical cells shorter, nearly rhomboidal*; *quadrate alar cells numerous*, sometimes extending up $\frac{1}{2}$ length of leaf on the margin, often somewhat transversely elongated; perichaetial leaves long-acuminate, dentate or denticulate above and costate to the middle. Monoicous; seta 0.5-1.5 cm. long, purplish below; capsule oblong to oblong-cylindric, cernuous and curved, brown to reddish, \pm contracted below the mouth when dry and empty, with operculum 1.5-2 mm. long; operculum conic to long-conic and apiculate; annulus broad; peristome perfect; cilia 1 or 2; spores in summer; calyptra as long as capsule, split $\frac{1}{2}$ its length. Type locality, Lancaster, Pennsylvania, U. S. A.

ILLUSTRATIONS:—Hedw. l. c.; Sull. Icon. Musc. pl. 121; Cheney, Bot. Gaz. 24: pl. 11, f. 5; M. H. M. figs. 202 & 203.

EXSICCATI:—Drumm. Musc. Am., S. States 113; Sull. Musc. Allegh. 28; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 344, (Ed. 2) 521, 522; Aust. Musc. Appal. l. c.; Grout N. Am. Musc. Pl. 144, 144a; R. & C. Musc. Am. Sept. Exsic. 247.

Southern Canada west to the Rocky Mts., south to West Virginia and Texas. Common on stones and bases of trees in shaded places in New England and adjacent territory.

Distinguished from *Hypnum reptile* by its terete branches, equally spreading, and entire short-acuminate leaves; from *Amblystegiella subtilis* by its larger size and more numerous quadrate alar cells, curved capsules and perfect peristome; from nearly all forms of *Hypnum cupressiforme* by its small size and non-secund leaves; the leaves individually remind one of *Pylaisia* but the non-secund leaves and curved capsules with perfect peristomes make separation easy.

Plants growing on stones sometimes have the leaves as broadly ovate and short-acuminate as those figured by Cheney, with the quadrate alar cells very numerous and the cells of the upper $\frac{1}{4}$ of the leaf rounded diamond-shaped, as figured by Sullivant. On trees the leaves are often more gradually narrowed to a longer acumination, becoming oblong-lanceolate, as figured by Sullivant. In this form the quadrate alar cells are much less numerous and the median and upper cells more elongated as figured by Cheney.

Platygyrium repens, when sterile, is often difficult to distinguish from *H. adnatum*, but the more slender acumination and longer leaf cells of *Platygyrium* will distinguish it to the practiced eye.

2. HOMOMALLIUM MEXICANUM Cardot, Rev. Bryol. 37: 53. 1910.

Plants in rather thin interwoven mats or patches, dark- to yellowish-green, more or less divided, somewhat regularly pinnate with branches of unequal length; branches erect to ascending; leaves crowded, erect-open even when dry, sometimes somewhat secund, especially at stem and branch tips, ovate-lanceolate, more slenderly acuminate than in the last, concave, with margins often somewhat reflexed below, entire or frequently sinuate-dentate above, ± 1 mm. long; costa double, short, or lacking; median leaf cells hexagonal-oblong to oblong-linear, rather thick walled, about 7μ wide, 4-5 : 1; quadrate alar cells minute, about 7μ in diameter, numerous, extending along the margin $\frac{1}{4}$ - $\frac{1}{2}$ length of leaf; perichaetial leaves more or less dentate above. Monoicous; seta about 1 cm. long; capsule oblong cylindric to oblong-ovate, cernuous and more or less curved, more or less contracted under the mouth when dry and empty; annulus present; operculum conic-apiculate to rostellate; peristome perfect; spores in August.

Type locality state of Hidalgo, Mexico, Pringle, nos. 10631 & 15250, 1908.

Cardot (l. c.) says much more robust than *H. adnatum*, this species approaches *H. loriforme* (Broth.) Broth., from the Himalayas, from which it differs in the less concave leaves, the shorter and less slender acumination, the thicker walls of the leaf cells and the smaller alar cells.

ILLUSTRATIONS:—Pl. 36.

EXSICCATI:—Grout, N. Am. Musc. Pl. Suppl. 4; Bartram, Mosses of Southern Arizona, 127 & 128.

On soil and base of trees alt. 6000 ft. or above. Also collected in New Mexico, White Mts., Lincoln Co., Wooton & Standley, no. 3977; Cloudcroft, Sacramento Mts., Wooton, no. 3755 (in part); Grant Co. Holzinger.

Distinguished from *H. adnatum* by its more robust appearance due to its relatively larger size and more spreading leaves with a more slender acumination, which is sinuate-dentate in the plants from New Mexico and Arizona.

Var. LATIFOLIUM Card.

Plants as a whole much more robust; leaves reaching 1.5 mm. long, more closely imbricate, broadly ovate, abruptly short-acuminate, very concave, entire; quadrate alar cells rather more numerous.

Type in Herb. Cardot at Natural History Museum, Paris and cotype in Herb. A. J. Grout, from White Mts., Lincoln Co., New Mexico, Wooton and Standley, no. 3786, 1907. N. Am. Musc. Pl. 460. Pl. 36.

A well-marked variety, possibly a good species. Also collected in the Santa Rita Mts., southern Arizona by Bartram.

Homomallium incurvatum (Schrad.) Loeske is reported from Newfoundland in Barnes and Heald's Key, but neither Macoun in his Catalogue of Canadian Plants nor Brothrus in Engler & Prantl mention it as American and I have been unable to find an American specimen.

6. AMBLYSTEGIELLA Loeske, Moosfl. d. Harz 294. 1903.

Plants small to minute, very slender, in very thin mats or patches, dark to light green; stems without central strand, filiform, irregularly branched, creeping; branches short and erect or longer and variously arranged; paraphyllia lacking; leaves rather loosely arranged, equally erect-spreading, scarcely decurrent, lanceolate to lance-subulate, with plane entire margins (except some leaves of *A. Sprucei*); costa entirely lacking or short and double; median leaf cells oblong-hexagonal to rhomboidal, 2-4 : 1, rarely twice this; alar quadrate (except in *A. minutissima*); capsules erect and symmetric to horizontal and curved; peristome hypnaceous with cilia rudimentary or lacking to well developed and 1 or 2; operculum convex to long-conic. Type species, *A. Sprucei*.

In its lack of central strand and costa this genus resembles the Hypneae much more than the *Amblystegiae* and the short and relatively broad leaf cells are found in many species of the Hypneae.

Nearly all our species have a tendency to become stoloniferous and the stolons have leaves much smaller than the normal. *Leskea tectorum* var. *flagellifera* Best is likely to be confused with *Amblystegiella*, especially *A. confervoides*, but the median cells on the flagella are scarcely longer than broad and usually some normal *Leskea* leaves can be found by which to determine the plants.

KEY.

1. Plants growing on the base of deciduous trees; leaves reaching 0.6 mm. or more in length..... 1. *subtilis*.
Plants growing on stone, especially limestone; leaves usually less than 0.5 mm. in length. 2.
2. Leaves narrowly triangular-lanceolate, not narrowed to the insertion; alar cells at margin all longer than broad; median 5-8 : 1..... 4. *minutissima*.
Leaves narrowed to the insertion; median leaf cells shorter, alar quadrate..... 3.
3. Quadrate alar cells conspicuous: monoicous; capsules curved and cernuous..... 2. *confervoides*.
Quadrate alar cells very few (1-3 on the margin), or lacking in some leaves: dioicous; capsules erect or nearly so..... 3. *Sprucei*.

1. AMBLYSTEGIELLA SUBTILIS (Hedw.) Loske, l. c.

Leskea subtilis Hedw. Sp. Musc. 221. 1801.

Amblystegium subtile (Hedw.) Bry. Eur. fasc. 55-56. pl. 561. 1853.

Plants small and slender although *the largest we have in the genus*, in thin closely interwoven dark-green mats; stems prostrate, 1-3 cm. long, irregularly but freely branched; leaves lanceolate to linear-lanceolate, *slenderly long-acuminate*, narrowed to the insertion, not decurrent 0.25-0.6 mm. in length, entire, appressed when dry; costa short and faint or lacking; median leaf cells oblong-hexagonal, $\pm 8 \mu$ wide, 2-3 : 1; *quadrate alar cells numerous (± 10 along the margin) and often transversely elongated*. Monoicous; seta about 1 mm. long or less, brown; *capsules oblong-cylindric, 1-1.5 mm. long, nearly or quite erect and symmetric*; annulus present; cilia of peristome *rudimentary or lacking*; operculum convex to conic; spores August to September. Type locality, Switzerland. "Type in herb. Haller, Berne, Switzerland," according to Cheney, Bot. Gaz. 24: 252. 1897.

ILLUSTRATIONS:—Bry. Eur. l. c.; Cheney Bot. Gaz. 24: pl. 11, f. 3; M. H. M. figs. 201 & 202.

EXSICCATI:—Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 342, (Ed. 2) 519; Aust. Musc. Appal. 369; Grout, N. Am. Musc. Pl. 12.

On bases of hardwood trees in cool moist forests. Southern Canada and northern U. S. west to Minnesota and Wisconsin, south to New Jersey, Pennsylvania, Ohio and Illinois; not rare in New England and adjacent regions.

2. AMBLYSTEGIELLA CONFERVOIDES (Brid.) Loeske, l. c.

Hypnum confervoides Brid. Spec. Musc. 2: 153. 1812.

Amblystegium confervoides Br. & Sch. Bry. Eur. fasc. 55-56. pl. 562. 1853.

Amblystegium pseudo-confervoides Kindb. Rev. Bryol. 22: 84. 1895.

Plants dark green, in thin closely adhering patches on moist rocks in damp shaded places; stems 60-90 μ in diameter, freely branching, often with more slender stoloniferous branches or stem endings; leaves distant, ovate to ovate-lanceolate, erect-spreading, more appressed when dry, $\pm 0.1 \times 0.25$ mm. (Limpricht's measurements are considerably larger), acute or acuminate with acumination usually stout, entire or occasionally subdenticulate, ecostate; median leaf cells prosenchymatous, variously shaped, *oval, triangular, hexagonal, or rhomboidal*, averaging $7 \times 21 \mu$ but with wide variations above and below these measurements; *alar cells quadrate to irregular about 3 rows extending up the margin 5-10 cells*. Perichaetial leaves ovate-lanceolate, abruptly contracted into a narrow acumination which is denticulate at base. Monoicous; seta 5-8 mm. long; capsules with operculum 1.3-1.6 mm. long, ovoid to cylindric, *inclined to horizontal, symmetric to slightly curved*, not contracted below the mouth when dry, dark brown; *peristome perfect, with cilia*; annulus narrow; operculum conic-apiculate; spores late summer to autumn. Type locality Austria.

Type in herb. Bridel.

ILLUSTRATIONS:—Bry. Eur. l. c.; Cheney, l. c., f. 1. M. H. M., f. 202.

EXSICCATI:—Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 520, at least in part; Aust. Musc. Appal. 368; Grout, N. Am. Musc. Pl. 317. R. & C. Musc. Am. sept. Exsic. 326.

Cheney (Bot. Gaz. 24: 251. 1897) says "A small plant, very generally confused with *A. Sprucei* and *A. subtile*. . . . From the former it may usually be readily distinguished by characters referred to under that species" (i. e., *A. Sprucei* has leaves serrulate throughout, elongated cells in the alar region and linear ones at the apex) from the latter it is distinguished by the its smaller cells in the alar region and shorter and more irregular cells in the middle and apical regions. Futher, *A. subtile* shows a distinct trace of costa in most leaves and has its parts in general $\frac{1}{2}$ larger."

The author takes this opportunity of acknowledging his indebtedness to this monograph of Cheney's, which has been followed to a great extent.

New England, southeastern Canada, Ontario, along the Great Lakes, and in the Rocky Mts. Infrequent and local.

Forma *brevifolia* Grout, M. H. M. 377. 1910. Leaves shortly and broadly acuminate, leaf cells short 1-2 : 1. Macoun Canadian Musci 820 (a reissue in herb. Grout) and Dupret Mt. Royal, Montreal, Nov. 28, 1908. The latter the type in herb. Grout. (See note, M. H. M. 377.)

3. AMBLYSTEGIELLA SPRUCEI (Bruch.) Loeske, l. c.

Leskea Sprucei Bruch, Spruce, London Journ. Bot. 1845: 180. 1845.

Amblystegium Sprucei Bry. Eur. fasc. 55-56. pl. 561.

Plants about the size of the last and growing in similar situations, bright green above, becoming yellowish with age; leaves about the same size and shape as in the last, but *usually serrulate and more slenderly acuminate, distant, spreading*; often with multi-cellular brood bodies in the axils;* *median cells longer, 3-6 : 1; subquadrate or rectangular alar cells few (rarely more than 3 along the margin), none transversely elongated; perichaetial leaves ciliate-dentate above!* Dioicous; seta reddish purple, 0.5 cm. long, rarely reaching 1 cm.; capsule erect and symmetric or nearly so, subglobose to oblong-obovate, 0.5-1.5 mm. long by about $\frac{1}{2}$ as thick, funnelform or turbinate when dry and empty; operculum convex, mammillate to conic apiculate; annulus present; peristome without cilia; segments linear; spores in summer. Type locality Pyrenees. "Type in herb. Bruch, Berlin?" (Cheney).

ILLUSTRATIONS:—Bry. Eur. l. c.; Cheney, l. c., f. 2; M. H. M., f. 202.

EXSICCATI:—Drumm. Musc. Am. 190 (as *Hypnum confervoides*); Grout, N. Am. Musc. Pl. Suppl. 2.

On shaded subalpine rocks, occasionally on other substrata. Southern Canada, west to British Columbia, south in the mountains to New Mexico and New England. Cheney says "not uncommon locally."

Apparently overlooked and seldom collected. Mrs. MacFadden collected it several times in the Rocky Mt. section of British Columbia where it seems unusually well developed. Some of the setae were 15 mm. long and the opercula strongly apiculate.

4. AMBLYSTEGIELLA MINUTISSIMA (Sull. & Lesq.) Nichols, Bryol. 11: 5. 1908.

Hypnum minutissimum Sull. Mosses of the U. S. 78, and Sull. & Lesq. in Sull. Icon. Musc. 195. pl. 120. 1864.

Amblystegium minutissimum (Sull. & Lesq.) Jaeger & Sauerb. St. Gall. Nat. Gesell. 1876-77: 547.

Plants minute, pale green, in thin patches; stems closely appressed to the substratum, subpinnately branching; *leaves linear-lanceolate, distant, not narrowed to the insertion but broadest there, 0.3-0.4 mm. long, tapering evenly to the apex, serrulate above, nearly or quite ecostate; median leaf cells 40-60 μ long, 4-8 : 1; marginal alar cells about 2 : 1, scarcely differentiated from the other basal; perichaetial leaves, ovate, long acuminate, coarsely and irregularly dentate above.* Monoicous; seta about 5 mm. long; capsule ovoid, symmetric or slightly curved, *inclined to pendulous, or at times almost erect*, including operculum \pm 0.5 mm. long, contracted below the mouth and turbinate when dry and empty; operculum conic-apiculate, $\frac{1}{2}$ -1 times the length of the urn; annulus present, large; peristome perfect, with cilia; Spores in summer. Type locality, central and southern Ohio. Type in herb. Sullivant, Cambridge, Mass. (according to Cheney, l. c. 245).

ILLUSTRATIONS:—Sull. l. c.; Cheney, l. c. f. 4. M. H. M. f. 202.

EXSICCATI:—Sull. Musci. Allegh. 31 (in part, as *Hypnum confervoides*); Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 343, (Ed. 2) 520.

Very rare. On stones, preferably limestone, in moist shaded ravines, ranging, according to Jennings, from "New Jersey and Pennsylvania westward to Illinois, Ontario, the Rocky Mountains and British Columbia."

Sterile, this species is easily confused with *A. Sprucei*, careful observation will enable this species to be distinguished by its non-contracted leaf base and elongated alar cells.

* See Correns Vermehr. der Laubm. 254.

7. PYLAISIA Bry. Eur. fasc. 46-47. 1851. (Not Desv. 1814.)

Pylaisiella Kindb. Can. Rec. Sci. 1894: 21. 1894.

Plants in rather thin glossy-green mats. Stems creeping, subpinnately branching; branches short, erect or ascending, more or less recurved at the tips by reason of the strongly secund apical leaves; not radiculose; leaves erect-spreading, somewhat falcate-secund, especially when dry, acuminate, concave, ecostate or costa short and double; leaf cells linear, quadrate at the basal angles. Monoicous; paraphyllia none. Archegonia usually borne on stem; seta smooth, twisted to left above, to right below; calyptra cucullate; capsule erect, seldom slightly incurved; operculum conic or short-rostrate; annulus narrow; peristome double, inserted below mouth of capsule; segments attached to a wide basal membrane, free or adhering to teeth; cilia rudimentary or none.

Type species, *P. polyantha*.

Widely distributed in the north temperate zone.

The generic name *Pylaisia* was first used by Desvaux in 1814 to designate a new genus named in honor of De La Pylaie. The specimen upon which his genus was founded is stated to be nothing more than a depauperate form of *Hypnum denticulatum* L.

In 1851 Bruch and Schimper took up the name for a new genus founded on *Hypnum polyanthos* Schreb. DeNotaris in 1869 extended the genus *Pylaisia* by including *Orithoecium* of the Bry. Eur., and in this extended form it was degraded by Lindberg in 1879 to a subgenus of *Stereodon* of Mitten.

KEY.

- | | |
|--|----------------------------|
| 1. Segments of the endostome entirely free from the teeth..... | 2. |
| Segments partially or wholly adherent to the teeth..... | 4. |
| 2. Quadrate alar cells numerous, 10-15 along the basal margin..... | 3. |
| Quadrate alar cells, 3-9 marginal..... | 1. <i>polyantha</i> . |
| 3. Leaves ovate; operculum short-conic..... | 2. <i>Jamesii</i> . |
| Leaves ovate-lanceolate; operculum short-rostrate..... | 3. <i>subdenticulata</i> . |
| 4. Segments partially adherent to the teeth; spores 18-24 μ in diameter..... | 4. <i>Schimperii</i> . |
| Segments wholly adherent; spores 25-30 μ | 5. <i>intricata</i> . |

1. PYLAISIA POLYANTHA Bry. Eur. fasc. 46-47. pl. 455. 1851.

Hypnum polyanthos Schreb. Spicil. Flor. Lips. 97. 1771.

Pylaisia heteromalla Br. & Sch. Lond. Journ. Bot. 2: 669. 1843.

Hypnum polyanthum pallidifolium C. Muell. Syn. 2: 337. 1851.

Pylaisia ontariense C. Muell. & Kindb. Macoun, Cat. Can. Pl. 6: 174. 1892.

Pylaisiella polyantha (Schreb.) Grout, Bull. Torr. Club, 23: 229. 1896.

Plants in glossy yellowish green intricate mats; stems 2 to 10 cm. long, rarely longer, creeping, pinnately branching; branches 0.5 to 1 cm. long, erect or ascending; branch leaves somewhat falcate-secund, loosely imbricate when dry, broadly ovate-lanceolate, 1-1.3 x 0.4-0.5 mm., more or less long-acuminate, entire, slightly concave, ecostate, or costa very faint, short and double; leaf-cells linear-rhomboidal; median cells 8 : 1; quadrate alar cells (3-9 along the margins); stem leaves broader, more abruptly acuminate; perichaetial leaves loosely sheathing, squarrose at apex; inner oblong-lanceolate, more or less long-acuminate, more or less serrate at apex, ecostate; cells linear above, rhomboidal and hyaline below. Seta red-brown 1-2 cm. long; capsule lighter red-brown, oblong-cylindric, 2.5 mm. long, 3.5-4 : 1, often stomatose at base; operculum conic to conic-apiculate; annulus very narrow and easily detached, of one row of cells; teeth of peristome linear-lanceolate, closely and regularly articulate, submoniliform and slightly granular above; segments as long as teeth, linear-lanceolate, strongly carinate, more or less split when old, granular-roughened; cilia single, usually rudimentary; spores brownish yellow, minutely roughened, 14 μ , maturing in autumn and winter.

Type locality European.

On trunks and roots of trees. Not common.

ILLUSTRATIONS:—Bry. Eur. 1. c.; Husnot. Musc. Gall. pl. 89; Limpricht, Laubm. 3: f. 354. Pl. 35.

EXSICCATI:—Drumm. Musc. Am. 222; Aust. Musc. Appal. Suppl. 1. 537; Macoun, Can. Musc. 260 (in part) and 264 (as *P. heteromalla*); Grout. N. Am. Musc. Pl. 452 and Musci Perfecti 136; Bartram, Mosses of S. Arizona 51.

Apparently widely distributed in Canada and along the northern border of the United States in mountainous regions, but rather infrequent and local; more frequent in the Northwest; south to Arizona and Alabama.

The typical form of this species is quite variable in leaf characters even on the same plant, but it differs constantly from European specimens in that the leaves are shorter, more abruptly acuminate and more broadly ovate-lanceolate. The length of the leaf of the European form averages 1.5 mm., that of the American 1 mm., though I have found one plant whose leaves measured 1.4 mm. The length of the acumination of the perichaetial leaves is also very variable. It may be found that our forms of this and the next species are but two varieties of the European *P. polyantha*. The American *polyantha* approaches the description of *P. polyantha brevifolia* Lindb. & Arnell, Musc. Asiae-bor. 152. 1890. I have seen the type specimens of *P. heteromalla* from Schimper's herbarium and not only are they *P. polyantha*, but Schimper himself indicated clearly on his labels that he did not consider it a good species; Drummond's no. 222, on which this species was founded, is evidently somewhat mixed as the Columbia Herbarium specimen is *P. intricata*.

Var. PSEUDO-PLATYGYRIA (Kindb.) n. comb.

Pyloisiella polyantha pseudo-platygyria (Kindb.) Grout, Bull. Torr. Club, 23: 230. 1896.

Pyloisia pseudo-platygyrium Kindb. Macoun, Cat. Can. Pl. 6: 173. 1892.

Pyloisia filari-acuminata Kindb. l. c. 174.

Leaves narrowly long-acuminate; upper branch leaves distantly serrate-dentate along sides of acumination; inner perichaetial leaves often long-acuminate, serrate-dentate along the acumination; cilia 1 or 2, better developed than in the type.

Type locality, shores of Lake Nipigon, Ontario. Also found on the west side of the Columbia River at Revelstoke, B. C.; Shoreham, Vermont.

On decayed trunks and on "logs subject to inundation."

EXSICCATI.—Macoun, Can. Musc. 626. (*Pyloisia filari-acuminata*.)

Var. BREVIFOLIA Lindb. & Arnell, Musc. Asiae-bor. 152. 1890.

Intermediate between *P. polyantha* (Schreb.) Bry. Eur. and *P. subdenticulata* Schimp. It has the shorter acuminate, subdenticulate leaves and more numerous quadrate alar cells of the latter and the conic operculum and rudimentary cilia of the former. I have not seen authentic Old World material of this variety, but the New Mexico plant corresponds well with the description in Limpricht's *Laubmoose* 3: 12. It may well prove to be a new variety when more material is available.

Cloudcroft, Sacramento Mts., Otero Co., New Mexico, Aug. 8, 1899. E. O. Wooton.

2. PYLAISIA JAMESII Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 383. 1865.

Pyloisiella polyantha Jamesii (Sull.) E. G. B. Bull. Torr. Club. 23: 230. 1896.

Pyloisia subdenticulata obscura Lesq. & James, Manual. 309. 1884.

Leaves ovate to broadly ovate, entire, gradually acute, or in the largest leaves (reaching 1.3 x 0.5 mm.) ending in a rather abrupt acumination of varying length; median leaf cells oblong to oblong-linear, about 7 μ wide, 3-6 : 1; quadrate alar cells numerous (10-15 marginal). Sporophyte scarcely to be distinguished from that of *P. polyantha*. Pl. 37.

Type from Chelsea, Mass. (James).

The type collection is apparently a poorly developed form of the specific type, as it is smaller than *polyantha* with teeth of peristome shorter than the segments. The fully developed western form is as large as *polyantha* with longer peristome teeth. It has been collected in Nebraska, S. Dakota, Minnesota, Iowa and New Mexico. Apparently growing on the bark and roots of trees. This species has the alar cells of *subdenticulata* and the operculum of *polyantha*. Probably all three would better be regarded as variants of one species.

3. PYLAISIA SUBDENTICULATA Schimp. Bry. Eur. fasc. 46-47. 1851.

Pyloisiella subdenticulata (Schimp.) Kindb. Can. Rec. Sci. 1894: 22. 1894.

Pyloisia denticulata Sull. in A. Gray, Man. (Ed. 2) 52. 1856.

Plants darker green than the last, scattering or in thin mats, often closely intermixed with other species; stems 1-3 cm. long, irregularly divided, subpinnately branching; branches very short, usually less than 5 mm. long; branch leaves erect-spreading, ovate-lanceolate, 0.7-1 x 0.2-0.35 mm., gradually long-acuminate, more or less denticulate, especially above, concave, ecostate or costa thin, short or double; median cells

6-8 : 1; quadrate alar cells numerous (10-15 marginal); perichaetial leaves 1.5-2 mm. long, loosely sheathing; inner ovate-lanceolate, gradually or abruptly narrowed to a long point, more or less denticulate above, ecostate. Seta 8-17 mm. long, brown; capsule brown, cylindric, 1.5-2 mm. long, 4-5 : 1; operculum conic, short-rostrate; annulus very narrow, consisting of a row of isodiametric polygonal cells and a row of vesicular cells that often come off with the operculum; teeth of peristome linear-lanceolate, orange, closely and regularly articulate, submoniliform and granulose above; segments linear-lanceolate, a little longer than the teeth, more or less split above; cilia lacking; spores yellow-brown, minutely roughened, 10-12 μ , maturing in summer or early autumn.

Type locality American (Sullivant).

On trees. New York and New Jersey; Maryland; Jasper, Canada; Ohio; Athens, Ill.; New Mexico; Minnesota; Wisconsin; North Carolina.

ILLUSTRATIONS.—Sull. Icon. Musc. *pl.* 87; *Pl.* 37.

EXSICCATI.—Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 382; Aust. Musc. Appal. 290. Very close to *P. polyantha*, but distinguished by the reduced size, rostrate operculum, absence of cilia and numerous quadrate alar cells.

4. PYLAISIA SELWYNII Kindb. Ottawa Nat. 2: 156. 1889.

Pylaisia intricata Sch. Bryol. Eur. Fasc. 46-47: Pylaisia 2. 1851, as to plant described. Sulliv. Mosses U. S. 62. 1871. Lesq. & James. Man. 309. 1884.

Hypnum intricatum C. Müll. Syn. Musc. 2: 338. 1851.

Pylaisiella intricata Grout, Bull. Torrey Bot. Club 23: 231. 1896.

Pylaisia Schimperii Cardot, Bull. Herb. Boiss. I. 7: 373. 1899.

Plants in wide glossy-green intricate mats; stems 5-8 cm. long, creeping, pinnately branching; branches about 5 mm. long, erect or ascending, strongly recurved at tips, especially when dry; branch leaves secund, especially at the ends of the branches, ovate-lanceolate, 0.8-1.1 x 0.3-0.4 mm., more or less long-acuminate, entire or subdenticulate at apex, concave, ecostate or costa short, thin and double; median cells linear-fusiform, 7-12 : 1; quadrate alar cells numerous, (15-20 marginal) bordering the lower $\frac{1}{3}$ of leaf; stem leaves ovate to broadly ovate-lanceolate, more abruptly acuminate, costa short and double; leaf-cells broader, linear-rhomboidal; inner perichaetial leaves 2-2.5 mm. long, loosely sheathing, oblong-lanceolate, acuminate, denticulate above, costa diffuse, reaching middle; leaf-cells linear above, looser, rhomboidal and strongly porose below. Seta 12-17 mm. long, dark red-brown; capsule red-brown, ovoid to ovoid cylindric, symmetric, slightly narrowed at mouth, 2 mm. long, 3-4 : 1; operculum conic, erect or oblique; annulus of about 2 rows of cells; teeth of peristome subulate-lanceolate, closely and regularly articulate, light yellow-brown; segments longer than the teeth, adherent for $\frac{2}{3}$ their length, split below, united above; spores yellow-brown, minutely roughened, thick walled, 18-24 μ , maturing in autumn.

Type locality American.

ILLUSTRATIONS.—Sull. Icon. Musc. *pl.* 88; M. H. M. *pl.* 85.

EXSICCATI.—Sull. Musc. Allegh. 34; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 256, (Ed. 2) 380; Macoun, Can. Musc. 262 & 434; Ren. & Card. Musc. Am. Sept. Exsic. 89; Aust. Musc. Appal. 291 & 292; Grout, N. Am. Musc. Pl. 3, and Musci Perfecti 85.

Common in the United States and Canada east of the Rockies, south to Florida; Arizona, Bartram. Austin's 292 is the type of a form with ovate leaves and much more numerous quadrate alar cells, extending along $\frac{1}{2}$ the length of leaf margin. It grew on stone fences (in part), in dry exposed situations; median leaf cells 5-6 : 1; apical oblong-rhomboidal 2-3 : 1. It is approached by Kindberg's *P. Selwynii*.

This species is easily distinguished by its curved branches, numerous quadrate alar cells and partially adherent segments. It varies a great deal in length of leaves and in length of leaf-cells, length and color of capsule and size of spores. Authentic specimens of *Pylaisia Selwynii* Kindb. show that it is merely a form of this species growing in exposed dry places. The plants are darker and the leaves more strongly recurved than usual.

5. PYLAISIA INTRICATA (Hedw.) Sch. Bryol. Eur. Fasc. 46-47: Pylaisia 2. 1851. (as to the cited synonym only). Card. Bull. Herb. Boiss. I. 7: 373. 1899.

Pterigynandrum intricatum Hedw. Sp. Musc. 85. *pl.* 18. *f.* 1-5. 1801.

Pterogonium intricatum Schwaegr. in Hedw. Suppl. 1^a: 100. 1811.

Pylaisia velutina Sch. Bryol. Eur. Fasc. 46-47: Pylaisia 3. 1851.

Plants in wide glossy yellow-green mats; stems 5 cm. or more long, creeping; branches 5-10 mm. long, ascending, curved at tip; branch leaves loose, secund, especially when dry, ovate-lanceolate, 0.8-1.2 by

0.3 mm., more or less long-acuminate, entire or denticulate along the somewhat involute margin, concave, ecostate, or costa short, faint and double; median cells linear-fusiform, 8-10 : 1; quadrate alar cells few (less than 10 marginal); stem leaves much broader; inner perichaetial leaves 2 mm. long; loosely erect, oblong-lanceolate, long-acuminate, somewhat denticulate at apex; leaf-cells linear above, linear-rhomboidal and porose below. Seta 1.2-1.7 cm. long, brown; capsule brown, ovoid-cylindric, 2 mm. long, 4 : 1; operculum conic, strongly apiculate to short-rostrate; annulus narrow, of 2 rows of cells; teeth of peristome yellow-brown, linear-lanceolate, very closely articulate, bordered the entire length by the adhering segments; spores thick-walled, finely papillose, dark yellow-brown, 24-30 μ , maturing in late summer or early autumn.

Type locality Lancaster, Pennsylvania.

On bark of trees, old logs, etc.; New Brunswick, and Mt. Desert, Maine; south to North Carolina, west to Ohio and Indiana, Minnesota; Arizona, Bartram.

ILLUSTRATIONS.—Sull. Icon. Musc. *pl.* 89; M. H. M. *f.* 209.

EXSICCATI.—Sull. Musc. Allegh. 60; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 257, (Ed. 2) 381; Aust. Musc. Appal. 293 & 294; Macoun, Can. Musc. 470; Grout, N. Am. Musc. Pl. 188.

Distinguished from *P. Selwynii* by the entirely adherent segments, narrower leaves with fewer quadrate alar cells, and larger spores.

Cardot in studying Hedwig's types discovered that Hedwig's *Pterigynandrum intricatum* was identical with Schimper's *Pylaisia velutina* instead of *Pylaisia intricata* Schimp. Hence the changes of name.

8. PLATYGYRIUM Bry. Eur. fasc. 46-47. 1851.

Plants of small to medium size, with creeping irregularly branched stems; leaves equally spreading to rarely somewhat secund, ovate to oblong-lanceolate, acute to acuminate, ecostate or with short and double costa; median leaf cells broadly to narrowly linear; quadrate alar cells numerous. Dioicous; capsule erect, nearly or quite symmetric; operculum short-rostrate; peristome teeth narrow; inner peristome without cilia; segments narrow, linear. Type species *P. repens*.

Differs from *Pylaisia* chiefly in having the leaves not secund or falcate (*slightly secund in fuscolutescens*), and the very narrowly linear segments of the inner peristome.

KEY.

Plants growing on bark of trees or on wood; leaves less than 1.5 mm. long..... 1. *repens*.

Plants growing on rocks; leaves more than 1.5 mm. long..... 2. *fuscoluteum*.

1. PLATYGYRIUM REPENS (Brid.) Bry. Eur. fasc. 46-47. *pl.* 458. 1851.

Pterigynandrum repens Brid. Musc. Recent. Suppl. 1: 131. 1806.

Pterogonium repens Schwaegr. Suppl. 1: 100. *pl.* 27. 1811.

Neckera repens Schwaegr. Suppl. 3: Sect. 2. *pl.* 246. 1828.

Cylindrothecium repens De Not. Epil. 214. 1869.

Entodon repens (Brid.) Grout, Bull. Torr. Club, 23: 227. 1896.

Plants in rather thin intricate mats, varying from dark green to a lighter yellowish green; stems 2-6 cm. long, prostrate; branches short, cylindric, ascending, often slightly curved; ends of sterile branches often bearing numerous small bud-like gemmae in the axils of the leaves; leaves oblong-ovate to oblong-lanceolate, closely imbricate when dry, 0.7-1.2 mm. long by 0.3-0.4 mm. wide, acute to acuminate; margins recurved and entire; costa lacking or short and double in robust plants; apical cells rhomboidal, median linear, 8 : 1; quadrate alar cells numerous (8-12 marginal) and extending up the margin of leaf; stem leaves larger and proportionately broader; perichaetium 1.5 mm. long, sheathing below, spreading above; inner leaves oblong, long-acuminate, denticulate at apex, usually with a short thin double costa, upper cells linear, alar enlarged and rectangular. Dioicous; seta brown, 1-2 cm. long; capsule erect, about 3 mm. long, 4 : 1, brown; operculum long-conic to conic-rostrate; annulus of about 3 rows of small cells resembling the upper exothelial cells; peristome teeth linear-lanceolate, hyaline-margined (margin often lacking in immature plants), with raised lines at the base but without the fine cross striae at base characteristic of most hypnaeous peristomes; segments linear, usually free at base, nearly as long as teeth often split between joints; spores minutely roughened, maturing in early autumn.

Type locality, Switzerland.

On bark of trees, decaying logs and stumps. Europe, and North America east of the Rocky Mountains. Common.

ILLUSTRATIONS:—Schwaegr. l. c.; Br. & Sch. l. c.; Husnot, *Musc. Gall* pl. 89; Limpr. *Laubm* 3: f. 353; M. H. M. f. 208.

EXSICCATI:—Drumm. *Musc. Am. (S. States)* 98 and *Musc. Am.* 159 (*Neckera sericea*). Sull. *Musc. Allegh.* 45 (*Neckera sericea*); Sull. & Lesq. *Musc. Bor. Am. (Ed. 1)* 259, (*Ed. 2*) 385; Austin, *Musc. Appal.* 281; Ren. & Card. *Musc. Am. Sept. Exsic.* 235; Grout, *N. Am. Musc. Pl.* 151 & 360.

In a swamp in N. Carolina I collected a robust form with long acuminate branch leaves that were occasionally slightly serrulate at apex.

Var. *ORTHOCLADOS* Kindb. *Macoun, Cat. Can. Pl.* 6: 172. 1892.

Entodon repens orthoclados (Kindb.) Grout, *Bull. Torr. Club* 23: 227. 1896.

Platygyrium repens sciurioides Limpr. *Laubm.* 3: 7. 1896.

Platygyrium repens ramulis elongatis Bry. *Eur. pl.* 458. f. 3.

Glossy yellowish green. Branches much larger and longer; leaves larger, 1.2 x 0.4 mm., loosely imbricate, shortly bicostate.

Type from Skead's Farm near Ottawa (Macoun).

EXSICCATI:—Sauter in Breut. *Musc. Frond. Exsic.* 296; Macoun, *Can. Musc.* 259 in part.

This variety seems to me to be only a robust form of a variable species. It was not considered by Schimper as worthy of varietal rank, although he figures the form. I have seen Dr. Sauter's type and also Kindberg's and they are without doubt the same. Kindberg's criticisms in Macoun's Catalogue on the descriptions and plates of this species are entirely without point. The Columbia College specimens of Macoun's no. 259 contained no fragment of *Platygyrium*, but consisted of *Pylaisia polyaniha*.

Var. *ASCENDENS* (Schwaegr.) n. comb.

Pterogonium ascendens Schwaegr. *Suppl.* 3, 1²: pl. 243. 1828.

Distinguished from typical forms by the following characters more robust, branches more erect, julaceous; leaves closely imbricated, short-acuminate; the alar cells generally smaller, the marginal ordinarily elongated transversely; seta very slender; capsule smaller. The above description is translated from Cardot's description of the type in *Bull. Herb. Boiss.* 7: 375, pl. 8. 1899, and his figures are reproduced in *Pl.* 44. From his figures and description drawn from the type it seems evident that *Pterogonium ascendens* is merely a robust variety of *Platygyrium repens* with leaves unusually short-acuminate. Specimens very closely approximating Cardot's figures have been collected in Pine Hollow, Iowa, by Dr. Conard and doubtless are not rare.

I am morally certain it should not be confused with the preceding variety, as leaves from Kindberg's type have almost the extreme of slenderly acuminate leaves that are found in the species.

I think, also, that Bridel's *Pterigynandrum brachycladon* should be left out of account, for in *Bryol. Univ.* 2: 185. 1827, he cites Schwaegrichen's plate 110, which represents *Homalotheciella subcapitata* (Hedw.) Card. and describes his plants as "nervo ** brevissimo obsoletissimo saepius in rameis nullo"!! See *Bryologist* 5: 11. 1902.

2. PLATYGYRIUM FUSCULATEUM (Schimp.) Card. *Rev. Bryol.* 38: 40. 1911 and 35: 49. 1910.

Plants brownish green, in wide close, rather thin mats; stems prostrate, 4-5 cm. long, irregularly branching, branches suberect; leaves erect-open when moist, more appressed and more or less secund when dry, oblong-lanceolate to ovate-lanceolate, concave, entire, rather abruptly narrowed to a tapering acumination averaging about $\frac{1}{2}$ the length of the body of the leaf; margins recurved to the base of the acumination; costa short and double or lacking; stem leaves reaching 2 x 0.5 mm.; branch leaves shorter and relatively broader; median leaf cells linear, about 7 μ wide, 8-10 : 1; basal and apical cells shorter; quadrate alar cells numerous (10-15 on the margin) and reaching half way to the leaf middle, the lower marginal larger, the upper smaller and transversely elongated and obscure. Apparently dioicous; seta and capsule light brown; seta rather more than 1 cm. long; capsule oblong-cylindric, with operculum about 3 mm. long; operculum rostrate, about 0.7 mm. long; annulus present; peristome much like that of *P. repens* except that the linear segments are not usually open between the articulations; spores in winter (February). Type locality Orizaba, Mexico. The leaves in the type are more shortly acuminate than in most American specimens.

ILLUSTRATIONS:—*Pl.* 42, F.

EXSICCATI:—Bartram, *Mosses of S. Arizona* 123 and 40 (as *P. repens*); Grout, *N. Am. Musc. Pl.* 497. On rock face, White Horse Canyon, Santa Rita Mts., Arizona, Bartram. Sacramento Mts., N. Mexico, Wootton.

Bartram's moss seems certainly to be a *Platygyrium*, very distinct from *P. repens* in color, size, alar cells and habitat. N. Am. Musci Pl. 414 is a stunted gemmiferous form of *P. fuscoluteum* that in some plants has the alar cells of *repens*, but its color, habitat and best developed leaves show its affinity to *fuscoluteum*. Microscopically it is an intermediate form with leaves scarcely larger than in robust *repens* (From Black Mts. Grant Co., New Mexico, Holzinger).

9. TAXITHELIUM Spruce, Cat. 1867.

Plants slender to moderately robust, growing in flat tufts; paraphyllia lacking; leaves mostly close, more or less concave, dorsal and ventral smaller, mostly finely serrate; costa lacking; median leaf cells mostly prosenchymatous, usually bearing several papillae in a row over the face of the cell on the back; alar cells differentiated. Seta mostly smooth; capsules more or less inclined, ovoidal, unsymmetric, contracted under the mouth when dry and empty; peristomes perfect, opercula conic to conic-apiculate. 95 species, tropical and subtropical, only one of which comes within our range.

TAXITHELIUM PLANUM (Brid.) Mitt. Jour. Linn. Soc. 12: 496. 1869.

Hypnum planum Brid. Musc. Rec. Suppl. 2: 97. 1812.

Plants bright green, growing in rather thin loose patches; stems 1-3 cm. long, prostrate, radiculose below, more or less regularly and pinnately branched, somewhat complanately foliate; cortical cells rather large and clear; stem leaves loosely imbricate when dry, erect-open when moist, 0.9-1.1 mm. long, 0.4-0.5 mm. wide, ovate, acute to short-acuminate, concave, narrowed and somewhat decurrent at the insertion, entire to crenulate-serrate above; median leaf cells narrowly linear-flexuose, about 5 μ wide, 12-15:1, each with a row of minute papillae down the middle of the dorsal side; at basal angles a small group (2-6 marginal) of broader clear rectangular to quadrate alar cells; branch leaves smaller and more serrulate; perichaetial leaves nearly or quite smooth, the inner long-acuminate. Monoicous; seta reddish to orange, very slender, \pm 1.5 cm. long; capsule small, with a short neck, ovoid, including neck and operculum less than 1 mm. long, horizontal, unsymmetric, contracted under the mouth when dry; operculum depressed-conic, long-apiculate; annulus apparently lacking; peristome perfect, with single cilia; spores in late summer. Type from Porto Rico.

ILLUSTRATIONS:—Schwaegr. Suppl. 3; pl. 280; Pl. 42D.

EXSICCATI:—Grout, N. Am. Musc. Pl. 368.

On decaying wood and base of trees. Not rare in Florida, especially in the southern portion.

10. MITTENOTHAMNIUM Hennings, Hedwigia 41: 225. 1902.

Microthamnium Mitt. Jour. Linn. Soc. 12: 503. 1869. Not *Microthamnium* Naegeli in Kützing Spec. Alg. 352. 1849.

Stereohypnum (Hampe) Fleisch. Hedwigia 47: 273. 1908.

Plants slender (in our species), in rather loose mats; leaves spreading from an ovate, cordate or triangular base, acuminate; margins plane and serrulate; costa short and double or lacking, occasionally one branch reaching $\frac{1}{2}$ the length of the leaf; leaf cells short-linear, papillose on the back by projecting cell angles as in *Bryhnia*; differentiated alar cells present, usually small and subquadrate; branch leaves smaller, more shortly acuminate and more strongly serrate. Capsules small, ovoid to cylindric; peristome usually perfect with one or two cilia.

MITTENOTHAMNIUM DIMINUTIVUM (Hampe) E. G. B. Bryol. 17: 8. 1914.

Hypnum diminutivum Hampe, Linn. 20: 86. 1847.

Hypnum cubense C. Muell. Syn. 2: 267. 1851.

Hypnum thelistegum C. Muell. l. c. 269.

Hypnum squamulosum C. Muell. Bot. Zeit. 14: 440. 1856.

Hypnum perspicuum Hampe, Linn. 31: 529. 1862.

Hypnum campaniforme Hampe, Warming Videnok, Medd. Nathist For. Kjöbenhaur 1870: 289. 1870.

Ctenidium diminutivum Fleisch. Hedw. 47: 291. 1908.

Plants pale green to yellowish; stems irregularly to pinnately branched, slender, 1-2 cm. long; branches 2-5 mm. long; leaves spreading, small; stem leaves \pm 0.6 mm. long, ovate, acuminate, concave, clasping

and slightly decurrent at base; costa short and double or lacking (occasionally one branch reaching $\frac{1}{2}$ the length of leaf); margins plane and serrulate; median leaf cells oblong-linear, about 5μ wide, 4-7 : 1, papillose at back by the excurrent angles; a few alar cells denser and quadrate; perichaetial leaves short, scarcely covering the vaginule. Monoicous; seta 7-12 mm. long; capsules less than 1 mm. long, cernuous to drooping, ovoid, contracted under the mouth when dry and empty; operculum rounded-conic, apiculate; peristome perfect; spores in winter. Type locality, on rotten logs, Caracas, *Moritz no. 20*.

ILLUSTRATIONS:—Fleisch. *Hedwigia* 47: 291, f. 10; pl. 42. C.

EXSICCATI:—Grout, N. Am. Musc. Pl. Suppl. 8, also largely mixed with no. 483; Aust. Musc. Appal. Suppl. 545.

Bases and roots of trees and decaying wood, southern Florida, Mexico and West Indies to South America.*

This species might easily be mistaken for *Campylium hispidulum* but for the longer and more slender acumination of the leaves and the leaf cells papillose at back.

11. TRIPTEROCLADIUM (C. Muell.) Kindb. Eur. & N. Am. Bryin. 1: 31. 1896.

Hypnum sect. *Tripterocladium* C. Muell. *Flora* 58: 79. 1875.

One species.

TRIPTEROCLADIUM LEUCOCLADULUM (C. Muell. l. c.) Kindb. l. c.

Hypnum compressulum C. Muell. l. c. 80.

Platygyrium rupestre Kindb. Bull. Torr. Bot. Club. 17: 276. 1890.

Plants brownish-green, in wide loosely intertangled mats; stems very slender to filiform, rather stiff, reaching 5 cm. or more in length, pinnately branched; branches filiform, subjulaceous, attenuate, more or less in the same plane but irregularly placed, the upper median branches longest, reaching 15 mm. in length and often with pinnately arranged branchlets; pseudo-paraphyllia occasional in the leaf axils; stem and branch leaves loosely appressed when dry, slightly open-erect when moist; stem leaves ovate to oblong-ovate, ± 1.25 mm. long, rather gradually narrowed to an acumination of varying length and slenderness, entire or slightly serrulate above, somewhat narrowed to the decurrent insertion; margins more or less recurved near the base; median leaf cells $5-7 \times 30-50\mu$, linear, rather thick-walled, marginal shorter, none papillose; basal shorter; small thick-walled alar cells numerous, quadrate to irregular, extending 0.2-0.3 mm. up the margin and half way to the middle of the leaf base at the insertion; costa variable even on the same plant, single and reaching almost to the leaf middle or much oftener double and shorter, sometimes almost lacking; branch leaves smaller, with a shorter and broader acumination which is usually irregularly serrate above; leaves of branchlets much smaller and more sharply serrate; perichaetial leaves sheathing, the inner with a long serrate acumination which is more or less spreading. Monoicous; seta about 15 mm. long; urn of capsule from 1.25 to 2.5 mm. long, nearly erect and symmetric to strongly curved and horizontal, both forms found in the same tuft; peristome perfect, cilia single. Type locality, Oakland, Oregon (Harvey).

ILLUSTRATION:—Pl. 42.

EXSICCATI:—R. & C. Musc. Am. Sept. Exsic. 240.

Specimens of *Platygyrium rupestre* from the type locality and cotypes of both *T. leucocladulum* and *T. compressulum* at the New York Botanical Garden have been carefully studied and compared with all the available material of the genus. Any characters given in the original descriptions of the others can be duplicated in *T. leucocladulum* and often many of them in the same tuft. *P. rupestre* seems to be a form with extremely attenuate, little-branched stems, while *T. compressulum* has the branches less attenuate than in the type of *T. leucocladulum*. This species seems almost as variable along some lines as *Pseudisothecium stoloniferum*, from which its slenderness and the short and double costa at once distinguish it. Leiberg and Henderson have made several collections in Idaho. It will probably be found in collections from the Rocky Mt. region, as the inaccurate descriptions have made it very hard to identify.

12. VESICULARIA (C. Muell.) C. Muell. *Flora* 82: 467. 1896.

Omalia subsec. I, *Vesicularia* C. Muell. Syn. 2: 233. 1851 (in part).

Plants slender to robust, in wide thin mats; stems elongated, creeping, simple or divided, more or less regularly pinnately branched; leaves not decurrent, differentiated into dorsal, lateral and ventral; the lateral erect or slightly secund, rarely falcate-secund, sometimes broadly ovate, sometimes ovate-lanceolate or oblong-lanceolate, shortly acuminate or long filiform-acuminate; costa short and double; leaf cells, oval- to

* In the above I have drawn largely on Mrs. Britton's articles, *Bryol.* 6: 59 & 17: 8.

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oblong-hexagonal or even elongated rhomboid-hexagonal, often elongated in marginal row and forming a distinct border; alar cells not differentiated; dorsal and ventral leaves much smaller. Seta 1-2.5 cm. long, smooth; capsule horizontal to drooping, broadly ovoid to oblong-ovoid, usually symmetric and often contracted under the mouth when dry and empty; annulus present, peristome normal hypnoid; operculum convex to conic-apiculate, rarely short-rostrate. Exclusively tropical and subtropical. Found in the U. S. in southern Florida only and rare even there. Formerly included in *Ectropothecium*, from which it differs mainly in the broad loose areolation, much like that of some species of *Bryum*.

KEY.

1. Lateral leaves plainly falcate-secund, slenderly long-acuminate..... 3. *crassicaulis*.
Lateral leaves not falcate, scarcely or not at all secund,* acute to short-acuminate... 2.
2. Marginal cells of upper $\frac{1}{2}$ of leaf much narrower than the median..... 2. *amphibola*.
Marginal cells only slightly different from the median..... 1. *vesicularis*.

1. VESICULARIA VESICULARIS (Schwaegr.) Broth. Engler & Prantl, Musci (Ed. 1) 2: 1094. 1908.

Hypnum vesiculare Schwaegr. Sp. Musc. Suppl. 2: 167. pl. 199. 1827.

Leskia (Omalia) rutilans Brid. Bryol. Univ. 2: 332. 1827 (except var. *portoricensis*).

Ectropothecium vesiculare (Schwaegr.) Mitt. Jour. Linn. Soc. 12: 518. 1869.

Ectropothecium rutilans (Brid.) Mitt. l. c. 519.

Vesicularia malachita (C. Muell.) Hedwigia, 37: 251. 1898.

Plants in wide thin intricate mats, bright to yellowish green, brownish below; stems slender, prostrate, with branching irregular to subpinnate; branches arcuate, simple or with few short branchlets; dorsal and lateral stem leaves spreading, when dry imbricate and erect-open, broadly oblong-ovate to triangular, acuminate; margins nearly or quite plane and entire, rarely minutely denticulate at apex; upper leaf cells pellucid, hexagonal, about $30-40 \times 22-25 \mu$; ventral stem leaves smaller, concave, broadly oblong, cells in the upper part of the leaf, narrower; dorsal and lateral branch leaves subdistichous, spreading, when dry more or less crisped, ovate to rounded-ovate, shortly and abruptly acuminate, often unsymmetric at base, entire except at the very apex; costa short and double, often indistinct; cells about $29 \times 25-30 \mu$, hexagonal to subhexagonal, gradually longer toward the base; ventral branch leaves much smaller and narrower, triangular-ovate, short-acuminate; cells elongate-hexagonal, about $15-20 \times 40-50 \mu$; inner perichaetial leaves about 1.5 mm. long, ovate to oblong, filiform-acuminate, ecostate. Monoicous; male buds on the stem near the female; seta 1-1.5 cm. long "purple," smooth; capsule short-oblong, horizontal to pendent, contracted below the mouth when ripe and dry, $0.75-1 \times 0.5-0.6$ mm., rarely one fourth larger; operculum conic-apiculate; peristome perfect; cilia 2-3, often united at base. Type from Jamaica, W. I.

ILLUSTRATIONS:—Schwaegr. l. c.; Salmon, Bull. Torr. Bot. Club. 31: plates 13 & 14. 1904; Pl. 38.

Over various substrata in hammocks in southern Florida, Small and Grout, also Sanford, Rapp. West Indies and South America.

Var. POEPPIGIANA (Hampe) Broth. l. c.

Hookeria Poeppigiana Hampe, Icon. Musc. pl. 4. 1844.

Hypnum Montagnei Schimp. ex Monti in La Sagra, Hist. Cuba, Bot. 530 (in part). 1842.

Hypnum conostegum C. Muell. Syn. 2: 242. 1851 (except synonymy and Porto Rican habitat).

Ectropothecium flavoviride Mitt. Jour. Linn. Soc. 12: 518. 1869.

Stem leaves erect-spreading, often somewhat hooked at apex; the dorsal and lateral oblong to ovate, acuminate, about 1.5 mm. long, acumination slender and flexuous; lateral leaves unsymmetric at base; upper leaf cells hexagonal or subhexagonal, $50-70 \times 12-15 \mu$; basal longer, hexagono-rectangular; ventral leaves smaller, about 1 mm. long, slenderly and more abruptly acuminate from a broadly ovate or subquadrate base; branch leaves scarcely complanate, in several rows, often more or less hooked at apex, the dorsal and lateral about 1 mm. long, gradually acuminate; lateral more narrowly ovate-lanceolate, often unsymmetric at base, acumination shorter; upper cells more narrowly hexagonal to subhexagonal, $45-60 \times 12-15 \mu$, marginal in the upper part of leaf rather broader than the others; ventral branch leaves smaller, oblong, ovate, or ovate-lanceolate. Hammocks, southern Florida, Small.

ILLUSTRATIONS:—Hampe, l. c.; Salmon, l. c.; Pl. 38.

Rare. Distinguished from the typical form by the longer more gradually acuminate dorsal branch

* Except in *V. vesicularis Poeppigiana*.

leaves with broader marginal cells in the upper part, also by the more or less hooked dorsal and lateral leaves. Salmon states "From all forms of the variable *Ectropothecium amphibolum* Spruce, var. *Poeppigianum* may be at once distinguished by the less denticulate dorsal and ventral branch leaves, with wider marginal cells towards the apex of the leaf and by the wider areolation of the ventral branch leaves."

2. VESICULARIA AMPHIBOLA (Spruce) Broth. l. c.

Ectropothecium amphibolum (Spruce Ms.) Mitt. Jour. Linn. Soc. 12: 519. 1869.

Similar in many respects to the closely related *V. vesicularia*. Salmon says "Unless careful attention is paid to certain points the present species" (i. e. *V. vesicularia*) "is very likely to be confused with *E. amphibolum*. *E. vesiculare* type may usually be known by its smaller size, and more compact habit, with branches more complanate, spreading at right angles, and more or less arcuate; it is, however, by certain characters shown invariably by the branch leaves that the two species are best distinguished. In *E. vesiculare* the ventral branch leaves are broadly ovate-acuminate, and the areolation is lax, with hexagonal and subhexagonal cells measuring $15-20 \times 40-50 \mu$. In *E. amphibolum* the ventral branch leaves are more longly acuminate from a narrower ovate base, or are sometimes ovate-lanceolate; the areolation is narrow, with subprosenchymatous cells measuring $15 \times 80-100 \mu$. The dorsal and lateral branch leaves, also, of the two species show constant differences. In *E. vesiculare* the leaves are subentire, the margin being minutely denticulate only at the extreme apex; and the areolation of the leaf in the upper half is remarkably lax, with the marginal cells wide. In *E. amphibolum* the margin is more evidently denticulate for a greater distance below the apex; the areolation is decidedly less lax, and the marginal cells are distinctly narrower than the rest, often forming a kind of indistinct border, which is most evident when the leaf is viewed under a low magnification."

ILLUSTRATIONS:—Salmon, l. c.; Pl. 38.

Hammocks, southern Florida, Mrs. Britton, no. 611; Small, nos. 1399 & 1397. Also in West Indies and Brazil. Rare in Florida and probably vanishing.

3. VESICULARIA CRASSICAULIS (Mitt.) Broth. l. c.

Ectropothecium crassicaule Mitt. l. c. 517.

According to Salmon this species "is (as the type specimen in Mitten's herbarium shows) different from all the plants described above, and presents the following characters. The plant is straw colored, with here and there branches showing a rich fuscous tinge of color; the stem is closely pinnate, with branches of unequal length which are usually curved at the apex. The stem leaves are very crowded, and seen from the dorsal side of the stem are imbricate in several rows. They are gradually long-acuminate from a truncate broadly ovate or oblong base, the acumen is long, fine and flexuous, the margin is entire (with the marginal cells very distinct) except in the acumen where it is obscurely and minutely denticulate or subentire. The areolation is lax, with hexagonal or elongate-subhexagonal cells, the walls of which become subporose. The ventral stem leaves are smaller and wider, and the cells have thinner walls. They are suddenly acuminate from a subquadrate or broadly oblong truncate base; the acumen is long and usually filiform, and is often flexuously contorted. The points of all the stem leaves are *regularly hamate, being curved towards the ground. The branch leaves are crowded, and strongly hamate*; the dorsal branch leaves are lanceolate and ovate-lanceolate, attenuated to a fine acumen; the margin is entire below, minutely denticulate above; the cells are lax, and hexagonal in shape. The ventral branch leaves are smaller, and more abruptly acuminate from a broadly oblong or subquadrate base; the cells are more delicate, hexagonal in shape, but longer; the acumen is long and fine. Seta about 2 cm. long; capsule pendulous. The habit is very *hypnoid*, and in the regularly hamate leaves, all turned in one direction (so that the dorsal surface of the stem and branches has a smooth or almost glossy appearance, while viewed from below the stem and especially the branches bristle with the flexuose arcuate points of the leaves) the plant recalls such species as *Hypnum cupressiforme*" "Mitten's type is labeled '120 *Hypnum Montagnei* Schimp. in Mont. Crypt. Cuba, p. 530, t. 20. Hab. decayed logs in forests, Cuba, Wright, ex parte.'"

Collected in Nixon & Goodwin Hammocks, Dade Co., Florida, Small, no. 6252, Det. R. S. Williams. Also no. 5132 from Timm's Hammock.

13. ECTROPOTHECIUM Mitt. Jour. Linn. Soc. 12: 22. 1869 (in part).

A large genus of tropical and subtropical mosses differing from *Vesicularia* (which was included in it by earlier authors) chiefly in the narrower leaf cells, fusiform-rhomboidal to linear-fusiform.

ECTROPOTHECIUM CALOOSIENSE (Aust.) E. G. B. Bryol. 7: 50. 1904.

Hypnum (*Rhynchostegium*) *caloosiense* Aust. Bot. Gaz. 4: 161. 1879.

Plants in loose patches, dark- to yellow-green; stems prostrate, 5–8 cm. long, subpinnately branching; paraphyllia present, long-subulate; leaves subcomplanate, wrinkled and shrunken when dry, $\pm 1 \times 0.4$ mm., ovate, acute to short-acuminate, more or less serrulate above; margins plane or broadly incurved toward the base; costa double sometimes reaching nearly $\frac{1}{2}$ the length of the leaf; leaf cells linear-fusiform, $5 \times 54 \mu$; two or three alar decurrent; perichaetial leaves clasping below, inner serrate with coarse irregular teeth and suddenly contracted into a slender subulate recurved tip, which is only slightly toothed. Monoicous; seta about 2 cm. long; capsule ovoid, pendulous, strongly contracted under the mouth when dry and empty; exothecial walls with inflated mamilllose cells; peristome perfect, papillose; cilia 1 or 2 slender. Type from "Low Hammocks along the Caloosahatchie River, Florida, March, 1878, J. D. S. and C. F. A." Pl. 39.

Type seen. The only other collection seems to be that of Rapp, at Tampa, issued as N. Am. Musc. Pl. 477.

Austin describes the leaves as entire or obsoletely serrulate above, but the leaves in the type are mostly markedly serrate above as shown in the figure.

Distinguished from *Plagiothecium micans* by its darker color, broader leaf cells and the pendulous capsule.

Subfamily STEREOPHYLLEAE.

14. STEREOPHYLLUM Mitt. Musc. Ind. Or. 117. 1859.

Plants slender to rather robust; stems creeping with more or less numerous rhizoids on the under side, irregularly to subpinnately branching, usually complanate-foliate; leaves, especially the lateral, more or less unsymmetric, ovate- to oblong-lingulate, ovate-lanceolate, oblong or elliptic, acute or obtuse, mostly with plane entire margins, sometimes serrulate above; costa extending to the leaf middle or beyond; leaf cells rhombic to linear, smooth or papillose; quadrate alar cells numerous; capsules mostly cernuous to horizontal and unsymmetric, ovoid, often contracted below the mouth when dry and empty; annulus usually present, broad; peristome perfect, usually with well-developed cilia.

KEY.

- Median leaf cells linear-fusiform, smooth 1. *Donnellii*.
Median leaf cells rhombic, more or less papillose 2. *Wrightii*.

1. STEREOPHYLLUM DONNELLI (Aust.) Card. Mem. Torr. Bot. Club. 6: 207. 1897.

Hypnum (*Brachythecium*) *Donnellii* Aust. Bot. Gaz. 4: 162. 1879.

Plants small, in thin mats, bright- to yellow-green; stems slender with short irregular branches; stem leaves loosely imbricate, ± 1.5 mm. long, ovate-lanceolate, gradually acuminate, entire (rarely slightly serrulate above) not papillose; costa narrow and rather thin except at base, reaching nearly $\frac{1}{2}$ the length of the leaf; margins plane; median leaf cells linear-fusiform, $9-10 \mu$ wide, $4-7:1$; basal cells shorter; quadrate alar cells numerous, 15–25 on the margin, extending to the costa at base; perichaetial leaves small, similar "ecostate." Monoicous; seta slender about 1 cm. long; capsule very small, urn less than 1 mm. long, ovoid, inclined; operculum conic; inner peristome short, cilia often rudimentary. Type locality Pine Island, Charlotte Harbor, Florida; on roots of trees and over shell mounds. Type seen. Collected at type locality, Feb. 1932, by A. J. G. Pl. 42.

Except for the small delicate sporophyte this species is so different from the next as hardly to seem congeneric, yet it is so close to *S. leucosiegium* (Brid.) Mitt., which ranges from Mexico to the Argentine, that Mrs. Britton thinks the two identical. In so far as data at hand indicate, the author agrees with her.

2. STEREOPHYLLUM WRIGHTII (Sull.) R. & C. Musc. Am. Sept. Exsic. 57. 1892.

Omalia Wrightii Sull. Mosses U. S. 65. 1856.

Hypnum Wrightii Sull. Icon. Musc. 209. pl. 127. 1864.

Stereophyllum cubense Mitt. Jour. Linn. Soc. 12: 544. 1869 (according to R. & C. l. c.)

Plants in very thin loose patches, dark to yellowish green; stems 1–2 cm. long, prostrate, radiculose below, sparingly branched or divided, complanately foliate; leaves not crowded, more or less two ranked, dorsal oblong-lingulate, obtusely acute to rounded and serrulate at apex, somewhat narrowed to the insertion, with margins plane or inflexed on one side, about 1.5–2 mm. long, 0.6–0.9 mm. wide; costa stout,

extending at least $\frac{2}{3}$ the length of the leaf; median leaf cells rhombic to oblong-rhombic, more or less plainly papillose with a single papilla, about $8 \times 20-30 \mu$; basal shorter; subquadrate and transversely elongated angular cells numerous, 20-30 on the margin, often extending to the costa, obscure; lateral leaves narrower, unsymmetric, often with few quadrate alar cells on one side; subcircular paraphyllia occasional; perichaetial leaves subclasping, acuminate and serrulate above. Monoicous; seta slender, about 1 cm. long, light brown, becoming reddish when old; capsule light brown, 1.5-2 cm. long including operculum, oblong, nearly erect and symmetric or cernuous and slightly unsymmetric; operculum long-conic to short-rostrate; annulus lacking; peristome with single well-developed cilia; spores in winter. Type locality, San Antonio, Texas.

ILLUSTRATIONS:—Sull. 1. c.; Pl. 39.

EXSICCATI:—Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 269, (Ed. 2) 536; Aust. Musc. Appal. Suppl. 544; Grout, N. Am. Musc. Pl. Suppl. 7 & Musci Perfecti 210.

On bases of trees and decaying wood, Texas, N. Mexico and Florida; not rare in southern Florida. According to Mrs. Britton's notes at the New York Botanical Garden, *S. radiculosum* (Hook.) Mitt. 1. c. 542 is a synonym.

In some specimens the papillae are large and conspicuous, in others scarcely apparent or wanting.

Subfamily PLAGIOTHECIEAE.

Distinguished from the *Hypneae* chiefly by the (usually) complanate and often distichous arrangement of the leaves, which, as a rule, are little or not at all secund; paraphyllia lacking and leaf cells smooth except in the subgenus *Taxiphyllum*. Capsules usually curved and cernuous with perfect peristomes. In a few instances the capsules are erect and symmetric and peristomes with cilia rudimentary or lacking.

15. PLAGIOTHECIUM Bry. Eur. fasc. 48. 1851.

Mostly loosely tufted glossy mosses growing on stones and soil, roots of trees and decaying wood; stems prostrate, irregularly branching; stems and branches appearing flattened by reason of the complanate or complanate-distichous leaf arrangement (except *Roseanum*, *pulchellum*, *striatellum* and *latebricola*). In many cases the complanate arrangement is brought about by twisting the leaves to either side making them unsymmetric; stem and branches often ending in stolons; paraphyllia lacking except as noted above. Stem and branch leaves usually much alike, ovate, ovate-lanceolate or oblong-lanceolate, acuminate, usually little concave; margins plane (with very few exceptions) and entire to strongly serrate; median leaf cells mostly linear-flexuose, differentiated alar cells few or not very different from the other basal cells (except in *striatellum* and *latebricola*); costa lacking or short and double (with occasionally a single fork of the double costa well-developed and reaching $\frac{1}{3}-\frac{1}{2}$ the length of the leaf); capsules oblong-ovoid to cylindrical, usually inclined and more or less unsymmetric (except in *latebricola*, *laetum*, *piliferum* and *Muellerianum*). *P. striatellum*, because of squarrose leaves and inflated alar cells, is likely to be sought under *Campylium*. *Hypnum pratense* because of its complanate leaves is often sought here.

The subgenera are raised to generic rank by Fleischer and Brotherus, but the division into genera in Engler and Prantl is so unsatisfactory that it seems better to wait a more logical division before accepting the probably inevitable split.

The leaves described are from the middle of well-developed branches.

Type species *P. denticulatum*.

KEY.

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|--|-----------------------------|
| 1. Leaves strongly decurrent..... | I. <i>Euplagiothecium</i> . |
| Leaves not decurrent..... | 2. |
| 2. Minute leaf-like paraphyllia present in many leaf axils in our species; upper leaf cells sometimes papillose at back..... | II. <i>Taxiphyllum</i> . |
| Not as above; plants mostly very slender..... | III. <i>Isopterygium</i> . |

I. EUPLAGIOTHECIUM.

- | | |
|---|-------------------------|
| 1. Leaves scarcely or not at all complanate*..... | 2. |
| Leaves plainly complanate..... | 3. |
| 2. Leaves squarrose-spreading; alar cells hyaline-inflated..... | 8. <i>striatellum</i> . |
| Leaves not squarrose; alar cells not inflated..... | 5. <i>Roseanum</i> . |

* *P. piliferum* may be sought here.

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|--|--------------------------|
| 3. Plants very robust, leafy stems 3-4 mm. wide, gray-green; leaves transversely undulate..... | 9. <i>undulatum</i> . |
| Not as above..... | 4. |
| 4. Plants dingy or yellowish green; leaves shrinking in drying so as scarcely to overlap..... | 2. <i>sylvaticum</i> . |
| Plants not as above; leaves scarcely shrinking..... | 5. |
| 5. Leaves slenderly acuminate; capsules erect and symmetric; peristome usually without cilia..... | 6. |
| Not as above; capsules occasionally suberect..... | 8. |
| 6. Leaves strongly concave, abruptly piliferous..... | 7. <i>piliferum</i> . |
| Leaves not as above..... | 7. |
| 7. Plants exceedingly slender, growing in lowland swamps..... | 6. <i>latebricola</i> . |
| Plants with the habit of slender <i>denticulatum</i> , growing in cool, moist crevices in elevated regions..... | 4. <i>lactum</i> . |
| 8. Edges of leaves strongly incurved and clasping the base of the leaf above, Fissidens-fashion; plants of swamps..... | 3. <i>Ruthei</i> . |
| Leaves not as above, only slightly incurved; plants of all moist regions..... | 1. <i>denticulatum</i> . |

II. TAXIPHYLLUM.

- | | |
|---|------------------------|
| Leaves clearly overlapping even when dry; leaf apex rarely bluntish, rather abruptly narrowed to a longer or shorter acumination..... | 10. <i>deplanatum</i> |
| Leaves scarcely overlapping when moist; leaf apex usually bluntish as in <i>Eurhynchium hians</i> | 11. <i>geophilum</i> . |

III. ISOPTERYGIUM.

- | | |
|---|---------------------------|
| 1. Leaves entire; plants very slender..... | 2. |
| Leaves serrate to merely serrulate near apex..... | 3. |
| 2. Leaves complanate; cortical cells conspicuously large and hyaline..... | 12. <i>Muellerianum</i> . |
| Not as above..... | 13. <i>pulchellum</i> . |
| 3. Leaves serrulate near apex only..... | 4. |
| Leaves serrate above; serrulate nearly or quite to base..... | 6. |
| 4. Leaves subultriform; capsules unknown; plants of cold mountain regions..... | 17. <i>subfalcatum</i> . |
| Leaves sometimes somewhat unsymmetric but much less so than in <i>subfalcatum</i> .. | 5. |
| 5. Plants light yellowish-green; costa very faint or lacking; capsules mostly less than 1 mm. long, without neck..... | 15. <i>micans</i> . |
| Plants darker green; costa evident in most leaves; capsules 1.5 mm. or more in length, with evident neck..... | 14. <i>elegans</i> . |
| 6. Leaves strongly falcate-secund, more or less complanate at base; capsules light-colored, about 3 mm. long; Pacific Coast plants..... | 18. <i>silesiacum</i> . |
| Leaves complanate, not secund; capsules shorter and darker; range extending across the continent..... | 16. <i>turfaceum</i> . |

I. EUPLAGIOTHECIUM

1. PLAGIOTHECIUM DENTICULATUM (L., Hedw.) Bry. Eur. fasc. 48. pl. 501.

Hypnum denticulatum Hedw. Sp. Musc. 237. 1801.

Plants in wide loose *glossy-green* flattened mats, varying greatly in robustness and color, irregularly branching; branches ascending to nearly prostrate, usually pointed in one direction; branch leaves neither distant nor crowded, complanate, somewhat spreading, scarcely shrinking when dried, usually slightly concave and unsymmetric, 1.5-3 mm. long, oblong-ovate, acute to short-acuminate, broadest slightly above the base, somewhat narrowed to the insertion and strongly decurrent, entire except for the occasional occurrence of a few short teeth near apex; lower margins more or less recurved, costa variable, short and double or lacking, again forking with one branch reaching $\frac{1}{3}$ the length of the leaf; median leaf cells linear to linear-rhomboidal, 10-15 μ wide, 10-15 : 1, usually full of chlorophyll, gradually becoming broader and shorter towards the base; basal cells subrectangular and pellucid; alar hyaline and decurrent. Monoicous; seta 2.5-4 cm. long; capsule typically 2-3 mm. long including lid, cylindric, with a distinct neck, inclined to

subhorizontal, more or less unsymmetric or curved, often striate when dry and empty; *lid long-conic to short rostrate; annulus large*; peristome perfect; spores in summer. Type locality European.

ILLUSTRATIONS:—Bry. Eur. l. c.; M. H. M. *pl.* 84; Jennings, Mosses W. Pa. *pl.* 48.

EXSICCATI:—Drumm. Musc. Am. 164 (in part only); Sull. Musc. Allegh. 51; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 351, (Ed. 2) 531, 532; Aust. Musc. Appal. 359 & 360; Grout, N. Am. Musc. Pl. 96, 267 & 267a; no. 96 is very near *sylvaticum*.

On stones, humus and rotten wood in moist shaded places. Common in Canada and the Northern U. S. South to Georgia in the mountains, also in Colorado.

This group, including the varieties and subspecies, of *denticulatum* is one of the most difficult to describe and define clearly, as the plants vary in pretty nearly every character with little apparent correlation. It is very difficult to distinguish many of the forms without authentic specimens for comparison. Different authors also describe the forms differently.

Forma *propaguliiferum* Ruthe, leaves strongly unsymmetric, very strongly decurrent, bearing linear-clavate 3-4-celled brood bodies at the back of the leaves. Swamps, Long Island, New York and Eastern Massachusetts, probably elsewhere. Apparently all of this group occasionally have these brood bodies.

Var. DONII (Smith) Lindb. Notis. Salsk. Fauna & Fl. Fennica. 1867.

Hypnum Donianum Smith, Fl. Brit. 3: 1286. 1804.

Hypnum obtusifolium Brid. Sp. Musc. 2: 93. 1812.

Very glossy; leaves soft, ovate, blunt or rounded at apex, often apiculate, concave. Alpine or sub-alpine, rare. N. Am. Musc. Pl. 288.

Var. TENELLUM Bry. Eur. l. c. *pl.* 502, f. β 1-7.

Much more slender, soft, shining; leaves oblong-lanceolate, 1.2-1.5 mm. long. In crevices in wet cliffs and ledges in cool shaded mountain regions. Not rare in New England. Austin's Musc. Appal. 361, issued as *P. denticulatum* var. *pusillum* seems to belong here.

Var. APTYCHUS (Spruce) n. comb.

Plagiothecium curvifolium Schlieph. Limpr. Laubm. 3: 269. 1897.

Plagiothecium denticulatum subsp. *aptychus* Spruce, Journ. Bot. 1880: 353. 1880.

Strongly resembling large forms of *P. sylvaticum* in size, color and general appearance, but leaves smooth and shining, not shrunken, with apices usually more or less curved downwards as in *P. deplanatum*; monoicous, capsules usually long cylindric-arcuate and strongly plicate when dry and empty, sometimes shorter and nearly smooth.

Type locality European.

Common on Vancouver Island and the neighboring coast; British Columbia, east to Montana.

A very striking and usually easily recognizable form. The European form is described as "capsules not plicate." Cardot identified N. Am. Musc. Pl. no. 93 as this species and the ripe capsules are smooth, but on another portion of the same collection were capsules that were older and plainly plicate. This western form seems clearly to be a local form of *denticulatum*. Allen, Mosses Cascade Mts. 116 is a fine example of this variety.

* 2. PLAGIOTHECIUM SYLVATICUM (Huds., Brid.) Bry. Eur. fasc. 48, *pl.* 503. 1851.

Hypnum sylvaticum Brid. Musc. Recent. 22: 53. *pl.* 1, f. 5. 1801.

Subspecies of *P. denticulatum* and intergrading freely. Larger, more yellowish in color; leaves softer, shrinking when dry so that the leaves do not overlap. Dioicous, capsule long-cylindric, usually more or less striate when dry and empty; operculum usually beaked.

Type locality European.

ILLUSTRATIONS:—Bry. Eur. l. c.

EXSICCATI:—Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 354; Grout, N. Am. Musc. Pl. Suppl. 10 (the larger plant in the specimen), Musci Perfecti, 4.

On wet humus, rocks and wood, in cool, shaded places. Northern U. S. and southern Canada across the continent, north to Alaska, south to Alabama.

Limpricht, Roth, and Moenkemeyer say that the capsules of *sylvaticum* are striate. Limpricht and Roth say that the capsules of *denticulatum* are not striate. Moenkemeyer says that the capsules of *denticulatum* may be striate. Husnot says of both species, capsules smooth or striate. Abbé Boulay says the same. Spruce and Dixon say that a striate capsule is correlated with a monoicous inflorescence.

Inflorescence is not a valid character in delimiting species in the Hypnaceae unless plainly correlated with other characters. Several plants of a tuft have been examined and all found female only to find the next with both archegonia and antheridia. Boulay finds in the same tuft male, female, and bisexual plants. I find both monoicous and dioicous plants with plicate capsules. The characters separating the two species

are exceedingly variable, as are the descriptions of numerous authors, but the herbarium material is fairly consistent. In Europe there is a form referred to this species that has color and shrunken leaves of this species but the leaves are almost equally spreading and erect-imbricate, more generally acuminate. This form culminates in

Var. *ORTHOCLADIUM* (Bry. Eur.) Schimp. Syn. (Ed. 1) 585. 1860.

Plagiothecium orthocladium Bry. Eur. pl. 504.

Aust. Musc. Appal. 366 seems to be this variety or close to it. There is also a darker smaller form with shrunken leaves that may belong rather to *P. denticulatum* but grows in habitats similar to *sylvaticum*, this may for the present be designated as var. *laxum* Mol. Alg. Alp. 97. 1865. This is well represented in the small dark form distributed as a part of N. Am. Musc. Pl. Suppl. 10, although the identification is not certain. As *sylvaticum* seems to be found in cool wet shaded places, it seems probable that the shrinking is due to the laxity of tissues grown under such conditions.

Var. *SUCCULENTUM* (Wils.) Husn. Musc. Gall. 352. 1893.

Hypnum denticulatum succulentum Wils. Bry. Brit. 407. 1855.

Very robust, probably the largest form of the *denticulatum* group; leaves reaching 3.5 mm. in length, often somewhat unsymmetric, ovate-oblong, gradually acuminate; costa strong, occasionally reaching $\frac{1}{2}$ the length of the leaf; occasionally synoicous.

Specimens labelled "the original of Wilson," comm. Levier, have been carefully compared with part of the type collection of *Plagiothecium fallax* Card. & Thér., Proc. Wash. Acad. Sci. 4: 336. 1902, from Alaska; this Alaskan moss (Juneau, April 4, 1904, coll. Mehner) is scarcely to be distinguished from Wilson's moss. The author believes *P. fallax* to be an unimportant variation that should be relegated to synonymy.

* 3. *PLAGIOTHECIUM RUTHEI* Limpr. Laubm. 3: 271. 1897.

One of the largest of the *denticulatum* group. Leaves complanate, with both sides of each leaf incurved and clasping the base of the leaf above, asymmetric, about 2.5 mm. long; costa $\frac{1}{3}$ – $\frac{1}{2}$ the length of the leaf. Type locality, Baerwalde, N. M., Germany.

N. Am. Musc. Pl. 55 & 55a. The Fissidens habit of the leaves gives the plants when fresh a peculiar and easily recognizable appearance, but there are all degrees of intergradation. The leaves often bear brood bodies. When dried the plants are more difficult of determination. Staten Island and Long Island, New York; Newfane, Vermont; Tallulah Falls, Georgia; Worcester, Mass.; Quebec; Minnesota; Maryland.

* 4. *PLAGIOTHECIUM LAETUM* Bry. Eur. fasc. 48. pl. 495. 1851.

Smaller than typical *P. denticulatum* with about the habit and appearance of *P. denticulatum tenellum* and apparently grading into it; leaves usually shrinking when dried, slenderly acuminate, less strongly decurrent, often with narrowly revolute margins. Monoicous; capsules erect and symmetric or nearly so; segments of inner peristome narrow, cilia lacking.* Type locality European.

ILLUSTRATIONS:—Bry. Eur. 1. c.; Pl. 40.

EXSICCATI:—Grout, Musci Perfecti 125; Aust. Musc. Appal. 362.

Mountains of New England, New York, Pennsylvania, eastern Canada, and New Mexico, rare. Drumm., Musci Am. 164 (in part), Height of Land, Rocky Mts., is near this, but presence or absence of cilia could not be determined.

* 5. *PLAGIOTHECIUM ROESEANUM* (Hampe) Bry. Eur. fasc. 48. pl. 504. 1851.

Hypnum Roeseanum Hampe msr.

Hypnum Sullivantiae Schimp. Bry. Eur. 1. c. 16; Sull. Mosses U. S. 680. 156. and Icones Musc. pl. 126.

Plagiothecium aciculari-pungens C. M. & Kindb. Cat. Can. Pl. 6: 216. 1892 (co-type seen).

Cespitose, irregularly branching; stems and branches erect to ascending, usually brittle, often nearly julaceous; leaves crowded, erect-imbricate and scarcely or not at all complanate, ovate-oblong, usually shortly and slenderly acuminate; costa various, sometimes strong and long; median leaf cells narrower than usual in the group (again in propaguliferous and poorly developed plants, shorter), elongate, about 15 : 1. Dioicous; capsules usually suberect, smaller than in most forms of *denticulatum*, operculum conic-apiculate to short rostrate.

Type locality European.

With the range of *P. Denticulatum* and even more common.

* Single cilia sometimes present according to Meylan, Rev. Bryol. 38: 110.

ILLUSTRATIONS:—Bry. Eur. l. c.; Sull. Icones Musc. l. c.; Pl. 39.

EXSICCATI:—Sull. & Lesq. Bor. Am. (Ed. 1) 355 in my set is scarcely characteristic; Aust. Musc. Appal. 364 & 365; Grout, N. Am. Musc. Pl. 434, 418, 125, 126; 126a is too close to *denticulatum*, 486 (issued as *P. denticulatum propagulifera*).

Our plants do not seem to be as bright green and glossy as described by European authors.

A form with propagula much like those shown for *denticulatum* in Limpr. Laubm. 3: 266 has occasionally been collected but the propagula seem to be found in the axils of the leaves. Slender dark to dirty-green forms with distant spreading, shrunk leaves growing on humus in swamps are frequent about New York City, Montreal, and elsewhere. The leaf cells in this form are often shorter, 5-10 : 1. It is probably a habitat form. At times these come near *sylvaticum* var. *laxum* in appearance. A portion of Austin's Musc. Appal. 364 is this form as is N. Am. Musc. Pl. 418. In most cases a few normal stems can be found in the tufts. It is probably f. *flagellaceum* (Warnst.) Moenkem.

Plagiothecium Sandbergii R. & C. Contr. U. S. Nat. Museum 34: 274. 1895.

From *P. laetum* and other small forms of *P. denticulatum* differs in its broader more shortly acuminate or apiculate more decurrent leaves. Areolation looser, cells much wider, costa longer and more distinct. Monoicous. Capsule erect. (Original description).

Hope, Kootenai Co., Idaho, August, 1892. (No. 1174.)

Cotype seen at N. Y. Botanical Garden.

Capsules not all erect, often much curved. The author regards this as a small but striking form of *P. Roeseanum* with very blunt often almost obtuse leaves and very wide leaf cells.

6. PLAGIOTHECIUM LATEBRICOLA (Wils.) Bry. Eur. fasc. 48, pl. 494. 1851.

Leskea latebricola Wils. ms.

Plants in small dense tufts, bright to yellow-green, glossy; as slender as forms of *P. Muellermanum* or *pulchellum*; stems short, with numerous short branches, 2 cm. long or less; cortical cells appearing as large as in *P. Muellermanum*; leaves more or less complanate, concave, spreading to erect-spreading, often somewhat secund at ends of stem and branches, strongly overlapping at base, ovate-lanceolate, gradually rather slenderly acuminate, 1 mm. long, usually strongly decurrent, entire and mostly plane-margined; costa short and faint or lacking; median leaf cells linear-flexuose, about 7 μ wide, 10-15 : 1; basal broader and shorter, short-rectangular to oblong-hexagonal; decurrent alar cells larger, rectangular, clearly defined and hyaline (2-4 along the margin and about the same number in width). Dioicous; seta usually about 1 cm. long; capsules oblong, erect and symmetric, light brown or yellowish, darker with age; urn less than 1 mm. long; operculum conic-apiculate; annulus narrow; peristome teeth and segments narrow, almost linear; cilia lacking or rudimentary; spores in late summer or autumn.

Type locality European (English).

ILLUSTRATIONS:—Bry. Eur. l. c.; Pl. 39.

EXSICCATI:—Aust. Musc. Appal. 353; Grout, N. Am. Musc. Pl. 25.

On decaying wood, roots of trees and hummocks of fern in lowland swamps. Newfoundland, Nova Scotia, Massachusetts, Ontario, Wisconsin, south to New Jersey; rare in most localities; apparently more frequent along the coast.

(See distinctions under *P. pulchellum*.) Under the microscope this species suggests a minute narrow-leaved form of *P. denticulatum* or *laetum* but the leaves are all entire and with narrower leaf cells. Forma *gemmascens* Ryan & Hagen is a form with numerous cylindrical septate gemmae in leaf axils and attached to leaf apices. *Plagiothecium attenuatirameum* Kindb. Macoun, Cat. Can. Pl. 6: 277. 1892, is a form with long slender attenuate branches, 1-15 cm. long and leaves slightly decurrent. Type seen. *Plagiothecium decursivifolium* Kindb. Macoun, Cat. Can. Pl. 6: 277. 1892, is a form of *latebricola* with narrower leaf cells, about 5-6 μ wide. Type seen.

7. PLAGIOTHECIUM PILIFERUM (Sw.) Bry. Eur. fasc. 48, pl. 496. 1851.

Leskea pilifera Sw. Summa Veg. Scand. 41. 1814 (name only). Hartm. Skand. Fl. (Ed. 1) 419. 1820.

Hypnum trichophorum Spruce, Musc. Pyren. exsic. 66. 1847.

Plants bright green or yellowish, in glossy flat interwoven patches; leafy stems and branches slender, 1-1.5 mm. wide; stems prostrate, freely but irregularly branching; cuticular cells hyaline, moderately thick-walled; branches suberect to arched; leaves subcomplanate, close, loosely imbricate, 1-1.2 mm. long by half as wide, broadly oblong-ovate, very concave, abruptly contracted to a slender filiform flexuose acumination of variable length, narrowed and narrowly decurrent at base; margin entire and narrowly reflexed in the body of the leaf; costa short and double or lacking; median leaf cells narrowly linear, about 6 μ wide, averaging 10 : 1; basal shorter and broader, at basal angles a few wider rectangular hyaline cells. Monoicous; seta 10-15 mm. long, bright red; capsules pale brown, about 2 mm. long, oblong to oblong-ovoid, with a distinct tapering neck, suberect and symmetric to inclined and slightly unsymmetric; exothelial walls thin and

sometimes irregularly shriveled when dry and empty; operculum conic; annulus present; *peristome without cilia, segments and teeth pale and slender*; spores in early summer. Type locality near Stockholm.

ILLUSTRATIONS:—Bry. Eur. l. c.; *Pl.* 40.

EXSICCATI:—Drumm. Musc. Am. 165 (as *Hypnum denticulatum Donianum*); Grout, N. Am. Musc. Pl. 71; R. & C. Musc. Am. Sept. Exsic. 325.

On bark of trees and moist stones in cool shaded elevated regions. British Columbia, Washington, Oregon, Wyoming and adjacent areas. Dixon notes that hair points of the leaves are sometimes inconspicuous on some of the branch leaves.

8. *PLAGIOTHECIUM STRIATELLUM* (Brid.) Lindb. Bot. Notis. 144. 1865.

Leskea striatella Brid. Bry. Univ. 2: 762. 1827.

Plagiothecium Muhlenbeckii Bry. Eur. fasc. 48. *pl.* 499. 1851.

Plagiothecium Fitzgeraldi Ren., Lesq. & James, Manual 370. 1884.*

Plants in dense dark-green mats; stems prostrate, irregularly branching; branches crowded, erect or ascending; *branch leaves crowded, squarrose-spreading*, 1–1.5 mm. long, ovate-lanceolate to ovate-triangular, gradually tapering to a long slender flexuose acumination, narrowed, rounded and decurrent at the insertion; margins plane and serrulate, at least in the upper part; costa short and double and lacking; median leaf cells linear-flexuose, *short for the genus*, 6–7 μ wide, 5–10 : 1; basal shorter and broader, colored and often pitted when old, *at the angles abruptly inflated, hyaline or colored, forming very distinct decurrent auricles*. Monoicous; seta red, 1–2 cm. long; capsules light brown, urn 1.5–2.5 mm. long, oblong-cylindric, inclined and curved with a tapering neck, plainly striate when dry and empty; operculum conic; annulus large; peristome perfect; spores May to June. Type locality, Newfoundland.

ILLUSTRATIONS:—Bry. Eur. l. c.; M. H. M. f. 200.

EXSICCATI:—Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 353, (Ed. 2) 533; Aust. Musc. Appal. 358; Grout, N. Am. Musc. Pl. 37, 312, Musci Perfecti 57.

Common in wet shaded places on stones, humus and rotten wood. Arctic America, south to N. Carolina.

9. *PLAGIOTHECIUM UNDULATUM* (L. Hedw.) Bry. Eur. fasc. 48. *pl.* 506.

Hypnum undulatum Hedw. Sp. Musc. 242. 1801.

Plants very robust with a *Neckera* habit; leafy stems and branches 3.5–4 mm. broad, growing in loose mats, soft whitish green; stems prostrate, reaching 10–15 cm. in length, irregularly branching, the longer branches 5–10 cm. long; stems and branches often attenuate at the ends, densely foliate; cuticular cells rather large and hyaline; leaves very large, 3–5 mm. long and about $\frac{1}{2}$ as wide, imbricate, complanate, broadly oblong-ovate, obtusely acute to short-acuminate, occasionally obtuse, *strongly transversely undulate*, dorsal and ventral unsymmetric, often incurved at the apices, little changed in drying, widest near the base and gradually narrowed to the decurrent insertion; margins plane and entire except at the usually irregularly dentate apex; costa short and double, stronger than in most other species of the genus; median leaf cells linear, 8–10 μ wide, 15–20 : 1 (marginal narrower), toward the base gradually becoming much shorter and broader, the rectangular hyaline decurrent cells at the angles little differentiated. Dioicous; seta 4–5 cm. long, red-brown; capsule long cylindric-arcuate, cernuous to horizontal, *striate when dry and empty*; urn 3–4 mm. long; operculum conic-rostrate, about 2 mm. long; annulus present; peristome perfect; spores in summer. Type locality European.

ILLUSTRATIONS:—Bry. Eur. l. c.; *Pl.* 40.

EXSICCATI:—Grout, N. Am. Musc. Pl. 72; Allen, Mosses Cascade Mts. 117.

On moist soil and rocks in cool shaded places. British Columbia and Northwestern U. S., south to California.

Var. MYURUM Card. & Thér. Univ. Calif. Pub. 2: 304. 1906.

Differs from the normal form in the subjulaceous branches, scarcely or not complanate; leaves subimbricate, slightly or not at all undulate, concave, often obtuse. Unalaska, Setchell and others.

Plagiothecium bifariellum Kindb. Bull. Torr. Bot. Club 17: 279. 1890, is a form of *Eurhynchium praelongum*. Type seen. *Plagiothecium brevipungens* Kindb. Macoun, Cat. Can. Pl. 6: 215 is not a *Plagiothecium* but a *Hygrohypnum*, scarcely to be distinguished from *H. subeugyrium occidentale* Card. & Thér. except by the larger cylindric-arcuate capsules. Type seen.

* A specimen collected in Florida on decayed trunks, Fitzgerald, in herb. Renauld, labeled *Hypnum Fitzgeraldi*, has been loaned by the Farlow Herbarium and carefully studied. It is apparently the type.

II. Subgenus TAXIPHYLLUM Fleisch. Laubm. Java 4: 1434. 1922.
(As a genus.)

Plants with the habit of moderately robust *Euplagiothecium*; leaves complanate and serrate nearly or quite to the base in our species; leaf cells elongated-rhomboidal to linear, more or less papillose on the back above in part of the species; small leaf-like paraphyllia present in the axils of many of the leaves; capsules ovoid, inclined; operculum rostrate in our species.

10. PLAGIOTHECIUM DEPLANATUM (Sull.) Grout, M. H. M. 370. 1910.

Rhynchostegium deplanatum Sull. Musc. Allegh. 50. 1846 (Schimp. ms.)

Plagiothecium missourianum R. & C. Ms. (According to a letter from Cardot.)

Plants bright golden green, in rather dense but thin mats; stems prostrate, 2-3 cm. long; branching irregular, branches mostly prostrate; leaves close and overlapping, complanate and regularly arranged in two rows so as to give the characteristic appearance of being regularly plaited or braided with apices slightly turned down, concave, little changed in drying or somewhat shrivelled; well-developed stem and branch leaves oblong-lanceolate to ovate, gradually or abruptly narrowed to a slender or stout acumination of varying length, often somewhat unsymmetric, especially at base, $0.5 \times 1.5-2$ mm., narrowed to the insertion but much less sharply rounded than in the next; leaves of young shoots and basal and apical branch leaves ovate and more shortly acuminate, often broadly acute; margins plane, sharply serrate above, serrulate nearly to base; costa very short, faint and double or lacking, very rarely longer; median leaf cells linear-flexuose, about 7μ wide, 8-12:1; basal shorter and broader; apical shorter in broad pointed leaves; at basal angles a small triangular group of short-rectangular to quadrate cells (3-6 on the margins), more numerous on the longer side of the unsymmetric base. Dioicous; capsule unsymmetric and inclined, contracted under the mouth when dry and empty and somewhat plicate; annulus lacking; peristome perfect; operculum short-rostrate; spores rarely produced. Type from eastern United States.

ILLUSTRATIONS:—Sull. Icon. Musc. pl. 108; M. H. M. f. 199; Pl. 42.

EXSICCATI:—Sull. Musc. Allegh. 50; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 296, (Ed. 2) 438; Aust. Musc. Appal. 344; Grout, N. Am. Musc. Pl. 174; Bartram, Mosses S. Arizona 161; R. & C., Musc. Am. Sept. Exsic. 198.

On moist shaded ground, and stones in shaded places, Nova Scotia to Minnesota, south to N. Carolina, Tennessee, Missouri, and Arizona; Alaska, *vide* Holzinger & Frye, Pub. Puget Sd. Biol. Lab. 3⁵⁸: 56. 1921.

An exceedingly variable plant as respects leaf form but with a plaited appearance, due to the regular arrangement of the leaves, that is easily recognized in the field, even without a lens. The only plant that looked like it in all the hundreds of *Plagiothecia* examined was a single stunted specimen of *T. geophilum*. In a lot of 25 collections in the author's collection there was not a single capsule. Sullivant's plate does not represent the leaves at all well. It would seem probable that the drawings were made from a slender-leaved form of *geophilum*. But his no. 296 cited above is true *deplanatum*. (See Musc. Allegh. 50, probably the type.)

The sporophyte has not been seen by the author but the description has been adapted from Sullivant with reservations. Bartram's Arizona plant from an altitude of 9000 ft. has abruptly acuminate leaves with much shorter leaf cells in the upper portion. It is apparently a xerophytic form and may be designated as f. *ovatum* n. f. From *Plagiothecium turfaceum* this species is distinguished by its plaited appearance, much broader leaves, with some of the leaves much more broadly pointed and with shorter upper cells. *P. elegans* has much more slender leaves, serrulate at apex only.

11. PLAGIOTHECIUM GEOPHILUM (Aust.) Grout, M. H. M. 370. 190.

Rhynchostegium geophilum Aust. Musc. Appal. 345. 1870.

Hypnum depressum James, Proc. Am. Phil. Soc. 1855. (Not of Bruch, Flora 7: 763. 1824. *nomen nudum*.)

Plants dark green, in wide thin loose mats; stems 5 cm. or more long, with leaves 2.5-3 mm. wide; branching irregularly pinnate; leaves distant, scarcely overlapping, widely spreading, complanate, somewhat distichous, symmetric and little changed in drying, oblong-lanceolate to oblong-ovate, narrowed and rounded to the insertion, not decurrent, gradually and rather evenly narrowed to an acute or subobtuse apex, 1.2-1.8 mm. long; margins plane, sharply serrate above, serrulate to base; median leaf cells linear-flexuose, about 6μ wide, 8-15:1; basal and apical shorter, a few short-rectangular, rather thick-walled cells at the basal angles; upper cells more or less papillose dorsally by the projecting angles of cell walls; costa short and double, usually stronger than in most species of subgenus *Isopterygium*, occasionally faint or lacking. Dioicous; seta slender, 1 cm. long or less, dark red-brown; capsules ovoid, unsymmetric and

inclined; urn usually less than 1 mm. in length; annulus present; operculum strongly beaked; spores in spring or summer, rarely produced. Type from New Jersey, Aust. Musc. Appal. 345.

ILLUSTRATIONS:—Sull. Icon. Musc. Suppl. *pl.* 70; M. H. M. *f.* 198.

EXSICCATI:—Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 437; Aust. l. c.; Grout, N. Am. Musc. Pl. 369, 369a, and 499 (as *P. deplanatum*).

On moist soil or stones in shady ravines, New York to Wisconsin, south to Maryland, Georgia, and New Mexico. Apparently frequent in portions of Ohio and Indiana and rare elsewhere.

The leaves are often much more slender and acuminate at apex than is shown in Sullivan's figures. The apices of the leaves bear a strong resemblance to those of *Eurhynchium hians*. Mr. A. J. Sharp collected a form of this species on moist soil, 5700 ft. elevation, State Line, Mt. Collins, Smoky Mts., Sevier Co., Tenn., May 15, 1932. The plants are the size and appearance of *P. sylvaticum*, yellow-green, growing in thick tufts, complanate; leaves very wrinkled when dry, not decurrent, with no differentiated alar cells, bicostrate with one branch often $\frac{1}{2}$ the length of the leaf or longer, entire below, serrate at or near the apex, asymmetrical.

III. Subgenus ISOPTERYGIUM Mitt. Jour. Linn. Soc. 12: 21. 1869.

(As a genus.)

Plants slender, mostly bright green and glossy; leaves not decurrent, mostly complanate; alar cells little or not at all differentiated.

12. PLAGIOTHECIUM MUELLERIANUM Schimp. Syn. 584. 1860.

Plants yellow-green, usually in thin loose mats, occasionally in thicker tufts with ascending branches; stems and branches slender, appearing strongly flattened, with the leaves 1.2–1.8 mm. wide; branching irregular, often tapering into stolons; *cortical cells enlarged and hyaline*, 3–4 times the width of leaf cells; leaves and leaf structure much as in *P. elegans* but rather abruptly acuminate, *entire*, with costa faint or lacking; leaves often turned upwards at the points, making the frond concave. Dioicous; seta 5–10 mm. long, chestnut-colored; capsules oblong-obovoid, symmetric and erect to somewhat inclined, long-necked, urn with neck 0.7–1.2 mm. long, brown, campanulate when dry and empty; annulus present; operculum conic-rostellate, at least $\frac{1}{2}$ the length of the urn; peristome perfect with rather short cilia; spores in autumn, rarely produced. Type locality European, the Tyrol.

On moist soil and rocks in cool ravines, especially in crevices. From Cape Breton, Nova Scotia to Ohio and Minnesota, south in the mountains to North Carolina; not rare but apparently local.

ILLUSTRATIONS:—Sull. Icones Musc. Suppl. *pl.* 66; M. H. M. *f.* 194.

EXSICCATI:—Aust. Musc. Appal. 351; Grout, N. Am. Musc. Pl. 59.

13. PLAGIOTHECIUM PULCHELLUM (Dicks., Hedw.) Bry. Eur. fasc. 48. *pl.* 497. 1851.

Leskea pulchella Hedw. Sp. Musc. *pl.* 55. *f.* 7–12. 1801.

Plagiothecium pseudo-latebricola Kindb.; Macoun, Cat. Can. Pl. 6: 211. 1892. Type seen.

Plants in rather dense bright-green patches or cushions, often intertangled with other mosses; *the most slender of all the Isopterygia* except forms of *Muellerianum*; stems short, prostrate, sending up numerous short (\pm 1 cm. long) suberect or curved branches like the pile of a coarse velvet; branch leaves rather close, erect-spreading, scarcely complanate, often somewhat secund at stem and branch tips, lanceolate to narrowly ovate-lanceolate; gradually narrowed from the widest part at the base to a very slender, moderately long acumination, slightly narrowed and rounded to the insertion, scarcely changed in drying, less than 1 mm. long; margins plane and entire; median leaf cells narrowly linear-flexuose, \pm 6 μ wide, 15–20 : 1; basal shorter, *alar scarcely different*. *Monoicous*; seta about 1 cm. long, brown to red-brown; capsules brown, oblong-cylindric to ovoid, with operculum 1.5–2 mm. long, suberect and nearly symmetric to somewhat curved and inclined, somewhat contracted under the mouth when dry and empty; operculum conic-apiculate; annulus large; peristome perfect; spores in early summer. Type from Scotland?

ILLUSTRATIONS:—Br. & Sch. l. c.; M. H. M. *f.* 197.

EXSICCATI:—Drumm. Musc. Am. 67; Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 530; Aust. Musc. Appal. 354 & 352 (as *P. passaicense* Aust.); Grout, N. Am. Musc. Pl. 144.

On decayed wood mainly, also on stones and roots of trees in cool shaded areas. Arctic America, south to New England, Pennsylvania, Michigan, Colorado, Wyoming, Montana, and Washington. Rare, but frequent in parts of British Columbia.

Var. *NITIDULUM* (Wahlenb.) Husnot, *Musc. Gall.* 354. 1894.

Hypnum nitidulum Wahlenb. *Flor. Lapp.* 370. 1812, excluding synonyms.

Plagiothecium nitidulum Bry. *Eur. pl.* 498.

Plants more robust; stems often stoloniferous at the ends; tufts thinner and straggling; branches spreading to nearly prostrate, more plainly complanate; leaves with a longer and more slender acumination; leaf margins sometimes slightly denticulate above. Forms occur with a very few differentiated alar cells.

With the species, apparently a habitat form; frequent in Rocky Mountain region. Allen, *Mosses Cascade Mts.* 146.

Slender forms of *P. Muellermanum* are distinguished at once by the large thin-walled cortical cells and *P. latebricola* by its strongly decurrent leaves.

Bartram has collected a moss (no. 600) in the Patagonia Mts. of Arizona that seems to belong to this species; the leaf cells are a trifle wider, 7-8 μ , and there is an occasional projecting cell along the upper leaf margin so that the leaves are not strictly entire.

14. *PLAGIOTHECIUM ELEGANS* (Hook.) Sull. *Mosses U. S.* 80. 1856.

Hypnum elegans Hook. *Musc. Exot.* 1: *pl.* 9. 1818.

Hypnum planifolium Brid. *Bryol. Univ.* 2: 411. 1827.

Plants in rather closely interwoven patches, dark to bright green, glossy, small and delicate; stems prostrate, 2-3 cm. long, irregularly branching; branches slender, usually less than 1 cm. long, procumbent or ascending, usually pointing in one direction, sometimes flagellate at the ends, with leaves about 2-2.5 mm. wide; cortical cells small and thick-walled; normal stem and branch leaves complanate and appearing two-ranked, not crowded, spreading, and equally and regularly arranged on each side of the stem, little changed in drying, often bearing in the axils gemmiform branchlets with minute leaves, symmetric, occasionally slightly secund, especially at stem and branch tips, oblong-lanceolate to ovate-lanceolate, averaging about 1.5 mm. long x 0.35 mm. wide, gradually narrowed from about the middle, then in most cases more abruptly narrowed above to a fine rather short acumination, somewhat concave, rounded at base to a rather narrow non-decurrent insertion; margins plane, entire except at the acumination, which is more or less serrulate in most leaves; costa usually evident, double, with one branch longer and sometimes reaching $\frac{1}{3}$ the length of the leaf; median leaf cells narrowly linear-flexuose, 4-7 x 70-100 μ ; basal row or two shorter, alar scarcely different. Dioicous; seta 12-20 mm. long, red-brown; capsules ovoid to oblong-ovoid, nearly symmetric but inclined or pendent due to a curve at the top of the seta, contracted under the mouth when dry and neck often somewhat wrinkled; urn about 1.5 mm. long; operculum conic-apiculate, obtuse; annulus well developed, of one or two rows of large deciduous cells; peristome perfect; spores in early spring, rarely produced.

Type from the Pacific coast of N. America, Menzies.

ILLUSTRATIONS:—Sull. *Icon. Musc. Suppl. pl.* 64; M. H. M. *f.* 195; Limpricht, *Laubm.* 3. *f.* 396 (gemmiform branchlets).

EXSICCATI:—Aust. *Musc. Appal.* 348; Allen, *Mosses Cascade Mts.* 145; Grout, *N. Am. Musc. Pl.* 143.

In moist shaded crevices of ledges of non-calcareous rock and on humus in similar situations, northern U. S. and Canada, across the continent, south to Long Island and New Jersey, and in the mountains to North Carolina and Tennessee, and in the west to California. Frequent in suitable locations.

As the type was from the Pacific slope, the description is based on *N. Am. Musc. Pl.* 143 from Seattle. Variation in leaf shape and size is great. Foster collected a very robust form as large as Var. *Schimper* (no. 441) at Cathlamet, Washington, that has the slenderly acuminate leaves somewhat secund, with the points turned down. From about the steam vents near the summit of Mt. Ranier, comes a slender, light-colored form, approaching var. *gracilens* in size and leaf form, but not complanate, though the characteristic gemmiform branchlets are abundant. When present these branchlets, different from the gemmae of any other species, serve for recognition; when sterile it may be distinguished from *P. micans* by its darker color, less contorted leaves having an apparent costa, and by the longer leaf cells, usually a little narrower; also it rarely fruits, while *P. micans* is a free and abundant producer of fruit; from *P. turfatum* it is distinguished by leaves serrulate at apex only; slender forms of the *P. denticulatum* group are sometimes referred to *elegans* but are readily distinguished by the larger leaf cells.

Var. *SCHIMPERI* (Jur. & Milde) Limpr. *Kryptfl. Schles.* 1: 83. 1876.

Plagiothecium Schimper Jur. & Milde in Rabenh. *Bryoth. Eur.* 588. 1861.

Seems to be essentially the robust form, with bright green leaves, 1.2-1.4 mm. long and 0.45-0.6 mm. wide. It is described as having the leaves broader and more shortly acuminate, often slightly falcate

above; gemmae apparently rare. Sullivant, Icon. Musc. Suppl. 86 refers to this variety as Lindberg's var. *terrestre* and cites Austin's Musc. Appal. 349. But this last seems to be merely a robust form with little difference except size.

Var. *GRACILENS* Aust. Musc. Appal. 350. 1870.

A very slender form, leafy branches about 1.5 mm. wide, leaves ovate to broadly oblong-ovate, short-acuminate, 0.7–0.9 mm. long, sharply serrate above in the type (Aust. Musc. Appal. 350), much smaller than this in other specimens; leaf cells shorter, mostly under 60 μ in length.

This variety is so different that Austin suggested a new species, but some of the collections have the gemmiform branchlets characteristic of the species. A form collected under an overhanging cliff on a cold north slope at Newfane, Vt., has narrower leaves than usual and approaches the more slender, narrower-leaved European var. *nanum* (Jur.) Walth. & Mol. Such forms and probably most var. *gracilens* are developed under unfavorable light conditions. This variety seems to have about the range of the species. Occasionally it is found in thick velvety cushions in crevices in ledges.

15. *PLAGIOTHECIUM MICANS* (Sw.) Paris, Index Bryol. (Ed. 1) 963. 1897.

Hypnum micans Sw. Muhlenb. Cat. 104. 1829 and Ann. Bot. 175. 1829.

Hypnum albulum C. Muell. Syn. Musc. 2: 280. 1851.

Hypnum subsimplex Sull. Musc. Allegh. no. 52, 1856. (According to C. Mueller.)

Hypnum tenerum Hook. & Wils. in Drumm. Musc. Am. S. States 108 & 109.

Plants in thin loose mats, usually *light yellow-green*, rarely darker, small; stems prostrate, slender, 2–4 cm. long, with leaves 1.5–2 cm. wide, irregularly branching, branches also prostrate, both rather firmly attached to substratum by numerous bunches of radicles; bunches of filaments often present in leaf axils; stem leaves thin, usually rather distant, more or less complanate, erect-spreading, occasionally somewhat secund, ovate-lanceolate, more or less contorted when dry, 0.75–1.2 mm. long, gradually long-acuminate, serrulate above, ecostate; branch leaves more shortly and more abruptly acuminate, the dorsal twisted and usually curved to one side, making them very unsymmetric, with the upper margin concave-incurved, more strongly serrate than the ventral, which are often entire; median leaf cells linear-flexuose, 6–8 μ wide, 9–13 : 1; basal shorter and broader, at insertion usually a row of noticeably shorter and broader cells extending across the base, these are sometimes lacking and often fail to be removed with the leaf; above these at the basal angles is a very small and variable group of subquadrate cells, in some specimens an inflated cell or two at angles, (well illustrated in Sullivant's plate); cortical stem cells fully as wide as median leaf cells; perichaetial leaves variable, the inner gradually long-acuminate or abruptly narrowed to a slender linear acumination, in either case serrulate above, in the latter case bordered at the narrowing with elongated cells and often coarsely dentate, both kinds of perichaetial leaves found on the same plant and even in the same perichaetium. Monoicous; seta slender, 1–1.7 cm. long, orange to reddish-brown; capsules small, urn without neck usually less than 1 mm. long, ovoid to short-oblong, light brown, dark when old, more or less contracted under the mouth when dry and empty, unsymmetric and cernuous; annulus lacking; operculum conic-apiculate to very short-rostrate, at least $\frac{3}{4}$ the length of the urn; peristome perfect with two cilia, usually shorter than the segments; spores in early winter. Type locality, southern United States?

ILLUSTRATIONS:—Sull. Icon. Musc. pl. 112; M. H. M. 367, f. 196.

EXSICCATI:—Drumm. l. c.; Sull. l. c.; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 302; Aust. Musc. Appal. 427 & 429; Grout, N. Am. Musc. Pl. 225; 214 & 274 as var. *fulvum*.

On rotten wood and soil at base of trees, from Long Island and New Jersey south to the Gulf of Mexico, especially near the coast, abundant in the southern states, west to Missouri. Immensely variable; the extreme variations are described in the varieties described below but all kinds of intermediate forms occur.

Through all its variations a few characteristics seem constant, the light color, the lack of costa, the cell structure of the leaf, and the small capsules on a comparatively long and slender, light-colored seta. The species fruits almost as freely as *P. striatellum*.

Var. *FULVUM* (Hook. & Wils.) Paris, l. c.

Hypnum fulvum Hook. & Wils. in Drumm. l. c. 110.

The largest form, stems and branches longer, wider, and more complanate, approaching in size and appearance small forms of *P. denticulatum* but lighter-colored or more brownish when old; leafy stems reaching 3 mm. in width in the type; leaves 1.2–1.7 mm. long, gradually and slenderly acuminate in the type and strongly serrate above. Capsules more than 1 mm. in length. Type duplicate seen. Usually

found in swamps and bogs. Probably further collections will indicate that this is at least a subspecies. Plants that seem to belong to this variety often have nearly entire leaves and in other cases the leaves are less slenderly acuminate. The bunches of short filaments in the leaf axils seems to be more conspicuous in the variety. Southern States, frequent.

Forma *LATIFOLIUM* Grout, n. comb.

P. micans var. *latifolia* Grout, N. Am. Musc. Pl. 408. 1922.

A robust form usually as large as the variety *fulvum*; leaves oblong-ovate, acute rather than acuminate, sometimes almost obtuse. Georgia, Florida.

Var. *MINUS* n. var.

Very small and slender, leafy stems and branches about 0.6 mm. wide; stem leaves \pm 0.5 mm. long; perichaetial leaves abruptly acuminate, sometimes scarcely serrulate; urn about 0.6 mm. long; seta usually less than 1 cm. long. Type from rotten log, Orange City, Florida, Grout, April, 1911. Type in herb. A. J. G. Also collected in Thomasville, Georgia by Mrs. Taylor, on soil and roots of trees.

Var. *GROUTII* (Card. & Thér.) Grout, n. comb.

Plagiothecium Groutii Card. & Thér. Bot. Gaz. 37: 379. pl. 24. f. 3. 1904.

A slender form a little larger than var. *minus* and more slender than typical *micans*; branch leaves and many of the stem leaves ovate to broadly ovate-lanceolate, 0.7–0.9 mm. long, abruptly narrowed to a short serrate acumination; dorsal leaves strongly unsymmetric, curved sidewise (subcultriform); beak as long as rest of operculum when dry; cilia well developed, often nearly as long as segments; perichaetial leaves mostly abruptly acuminate, slightly or not at all serrate as a rule. Spores in late autumn. Type from depression in base of old chestnut tree, Hempstead, New York, Dec. 1, 1899. Type in Cardot Herb. in Muséum d'Histoire Naturelle, Paris; cotype in herb. A. J. G.

ILLUSTRATIONS:—Card. & Thér. l. c.; Pl. 37.

Grout, N. Am. Musc. Pl. 196 is a type duplicate; Sull. & Lesq. Musc. Bor. Am. 302b closely approaches this variety as does Aust. Musc. Appal. 429. Dr. John K. Small collected a similar form from "Hammocks south of Coot Bay, Monroe Co., Florida, April 1, 1916, no. 7521." Oneco, Florida, Grout. All the collections except the type have few leaves as abruptly short-acuminate as the type. Contrary to the original description, most capsules of the type collection are contracted under the mouth when dry.

16. *PLAGIOTHECIUM TURFACEUM* (Lindb.) Lindb. Oefvers. Vet.-Akad. Förh. 14: 124. 1857.

Hypnum turfaceum Lindb. Fl. Dan. Suppl. fasc. 2: 17. 1857.

Hypnum pseudo-silesiacum Hook. & Wils. in Drumm. Musc. Am. S. States, III. 1841.*

Plagiothecium sulcatum Card. & Thér. Bot. Gaz. 37: 378. 1904.

Plants bright green, sometimes yellowish, growing in rather thin loose mats; stems prostrate, 2–4 cm. long, closely attached to substratum, irregularly branching; leafy stems 2.5–3 mm. wide; cortical cells thin-walled and somewhat wider than the median leaf cells; leaves ovate-lanceolate to oblong-lanceolate, long-acuminate, narrowed to the insertion, complanately spreading by the turning to the sides of the upper and lower leaves, occasionally somewhat secund with points turned down, about 1.5 mm. long, or less, sharply serrate above, serrulate nearly or quite to the base with distant teeth, costa short and faint or lacking, when present mostly single; median leaf cells linear-fusiform, about 6 μ wide and 10–12 : 1; basal somewhat shorter; alar scarcely different or a few more short cells than elsewhere at the base, occasionally a single inflated cell at extreme basal angle; perichaetial leaves ovate, abruptly acuminate, sharply serrate above; monoicous; seta 12–18 mm. long, light to red-brown, capsules oblong to oblong-cylindric, usually curved and inclined; urn 2 mm. long or a little less, wrinkled at the neck when dry, when dry and empty usually more or less plicate throughout; annulus large; operculum conic; peristome perfect; spores in summer. Type from Sweden.

ILLUSTRATIONS:—Sull. Icon. Musc. Suppl. pl. 65; M. H. M. pl. 83.

EXSICCATI:—Aust. Musc. Appal. 356; Grout, N. Am. Musc. Pl. 89 & 384, Musci Perfecti 61. Specimens of *P. sulcatum* Card. & Thér. of the type collection have been seen through the courtesy of Prof. Rosendahl of the Univ. of Minnesota.

* Cotype seen.

On decaying wood and humus in cool shaded moist places. Southern Canada and northern U. S., west to Ontario and Minnesota. According to Jennings "south to Georgia and Texas," but rare south of Pennsylvania and New Jersey. Apparently frequent in New England. It is found in Manitoba, British Columbia, and Northwest Territory according to Macoun. *P. turfaceum* has very much the appearance of large forms of *P. elegans* but its much more strongly serrate leaves will distinguish sterile forms. It fruits frequently and its capsules are inclined but never pendent. These are additional points of distinction. Occasionally the leaves are scarcely complanate, and these forms are puzzling.

17. *PLAGIOTHECIUM SUBFALCATUM* Aust. Musc. Appal. 366. 1870, and Sull. Icon. Musc. Suppl. 90. *pl.* 67. 1874.

Plants in rather thin intertangled, bright-green patches, resembling in gross appearance forms of *P. elegans* or small *denticulatum*; distinguished from the former by the rather broader, less slenderly acuminate leaves, which are also strongly unsymmetric and curved backwards, almost cultriform, lower margin often slightly recurved, leaf cells also slightly wider than in *elegans* and narrower than in *denticulatum*. Sporophyte unknown.

Crevices of rocks in the mountains of New Jersey, New York, Pennsylvania, New Hampshire, and Vermont, also near Foley, Lincoln Co., Missouri.

The relationships of this species are doubtful. It may be a derivative of *P. elegans*. Its non-decurrent leaves distinguish it from all forms of *denticulatum*, as will the much serrate leaf apices. Sullivant's excellent figures are the best means of determining this species. *Pl.* 43.

18. *PLAGIOTHECIUM SELIGERI* (Brid.) Lindb. in Th. Fries, Bot. Not. 144. 1865.

Leskea Seligeri Brid. Musc. Rec. 2: 47. 1801.

Plagiothecium silesiacum (Seliger) Bry. Eur. fasc. 48. *pl.* 500. 1851.

Hypnum silesiacum Seliger in P. B. Prodrum 70, 1805.

Plagiothecium repens Lindb. Notis. Sällsk. Fauna & Fl. Fennica 9: 36. 1867.

Plants comparatively robust, in loose pale-green tufts; stems creeping, irregularly branching; branches 15–20 mm. long, arched and often attenuate at the tips; leaves somewhat complanate, irregularly and widely spreading, especially when moist, falcate-secund, 1.5–2 mm. long, \pm 0.6 mm. wide, oblong-lanceolate to ovate-lanceolate, gradually narrowed to a long slender and flexuose acumination, sharply serrate above, serrulate below, narrowed and somewhat rounded to the insertion; margins plane; costa short and double, faint; median leaf cells linear-flexuose, \pm 6 μ wide, 10–15 : 1; basal shorter and broader, incrassate, more or less pitted and colored; a few angular subquadrate to rectangular on the margin, at the insertion often appear 1 or 2 hyaline thin-walled cells \pm 20 μ wide and below these are often detached large rectangular cortical cells about 15 μ wide; perichaetial leaves ovate to oblong, rather abruptly acuminate, more closely serrate than the others. Monoicous; seta light red, 15–20 mm. long; capsule long arcuate-cylindric, cernuous, with lid 3 mm. long, having a noticeable neck, scarcely contracted under the mouth when dry and empty, usually smooth and unwrinkled when dry and empty but with notable exceptions even in European plants; operculum conic-obtuse; peristome perfect; annulus present, of one or two rows of cells; spores in summer. Type locality European.

ILLUSTRATIONS:—Bry. Eur. l. c.; *Pl.* 42A, *Pl.* 43A.

EXSICCATI:—Allen, Mosses Cascade Mts. 115.

In both European and American specimens the capsules are often somewhat wrinkled if immature. Most European specimens have an annulus of a single row of cells but there are exceptions. Also the leaves are broader and more sharply serrate than shown in the Bry. Eur. figures. Some American students have confused *deplanatum* with *Seligeri*, but the leaf arrangement is strikingly different and the leaves of the former are relatively much wider.

On decaying wood and humus in cool elevated regions; rare in N. America. Washington, Allen; Columbia Falls, Montana, Williams; Vancouver, Id., Macoun; Edgewood, B. C., MacFadden.

Subfamily ENTODONTEAE.

Primary stems creeping; paraphyllia lacking; leaves not papillose, often plicate or concave, ecostate; median leaf cells linear, alar quadrate (except *Holmgrenia*). Seta smooth; operculum conic to short-rostrate; capsule erect and symmetric, not conspicuously contracted under the mouth when dry and empty; peristome mostly with narrow linear segments, attached to a narrow basal membrane; cilia rudimentary or wanting; teeth often without the fine cross lines on the lower sections.

Homalothecium, *Chamberlainia* and some species of *Plagiothecium* have the capsule characteristics of this subfamily, but in the two first the leaves are costate to the middle or beyond. The *Plagiothecia* have for the most part to be distinguished by their individual gametophyte characters.

KEY.

- | | |
|-----------------------------------|------------------------|
| Quadrata alar cells numerous..... | 1. <i>Entodon</i> . |
| Quadrata alar cells lacking..... | 2. <i>Holmgrenia</i> . |

1. ENTODON C. Muell. Linnaea, 18: 704. 1844.

Cylindrothecium Bry. Eur. fasc. 46-47. pl. 464, 465. 1851.

Plants in wide intricate mats. Stems densely leafy, creeping, subpinnately branching (stems erect and pinnately branching in *E. orthocarpus*); stems and branches more or less complanate-foliate; leaves many-ranked, imbricate, entire or slightly toothed at apex; costa short and double or lacking; leaf cells linear, enlarged and quadrate at the basal angles. Monoicous (except *E. orthocarpus*); seta long and smooth; capsules cylindric, erect and symmetric (rarely slightly curved); annulus large and conspicuous (except in *E. Drummondii*); peristome inserted below the mouth of the capsule; otherwise as described for the subfamily.

Type species *E. Schleicheri* (Bry. Eur.) Broth.

KEY.

- | | |
|---|---------------------------|
| 1. Leaves obtuse; quadrate alar cells in two or three layers..... | 7. <i>orthocarpus</i> . |
| Leaves acute or acuminate; quadrate alar cells in one layer..... | 2. |
| 2. Leaves gradually and narrowly acuminate; segments adhering to the teeth..... | 6. <i>brevisetus</i> . |
| Leaves acute to apiculate; segments free..... | 3. |
| 3. Seta yellow; annulus apparently lacking..... | 5. <i>Drummondii</i> . |
| Seta red; annulus present..... | 4. |
| 4. Leaves scarcely or not at all complanate..... | 2. <i>seductrix</i> . |
| Leaves strongly complanate..... | 5. |
| 5. Plants robust; leafy stems and branches more than 1 mm. wide; peristome teeth not strongly striolate or papillose..... | 1. <i>cladorrhizans</i> . |
| Plants slender; leafy stems and branches 1 mm. wide or less; peristome teeth striolate or papillose..... | 6. |
| 6. Leaves mostly serrulate at apex; teeth striolate above..... | 4. <i>Sullivantii</i> . |
| Leaves mainly entire; teeth uniformly papillose-roughened..... | 3. <i>compressus</i> . |

1. ENTODON CLADORRHIZANS (Hedw.) C. Muell. Linnaea, 18: 707. 1844.

Neckera cladorrhizans Hedw. Sp. Musc. 207. pl. 47. 1801.

Entodon transylvanicus Demet. Hedwigia, 23: 81. 1884.

Entodon minutipes Kindb. Can. Rec. Sci. 1894: 21. 1894.

Plants in wide soft glossy yellow-green intricate mats; stems about 5 cm. long, subpinnately branching; stems and short branches strongly complanate-foliate, lying in the same plane; branch leaves oblong-ovate, gradually narrowed to the insertion, about 1.5 x 0.6-0.8 mm., acute, with apex often slightly reflexed, entire or slightly denticulate at apex, very concave; margins plane or narrowly recurved below; median leaf cells linear-fusiform, 6 μ wide, 10-15 : 1; apical shorter, quadrate alar numerous (8-10 on the margin); stem leaves larger and broader at base, more abruptly acute; inner perichaetial leaves oblong-acuminate, denticulate at extreme apex. Seta 1.5-2 cm. long, light reddish-brown; capsule cylindric-ovoid, brown, up to 3.5 mm. long including operculum; annulus large; operculum conic-apiculate to short-rostrate; peristome .35-.4 mm. long, closely and regularly articulate and slightly granulose-roughened below, more distantly articulate and smooth or nearly so above, with a conspicuous median line, often perforate between the articulations; segments linear, as long as the teeth; spores in autumn. Type locality, Lancaster, Pa. (Muhlenberg).

On roots of trees, old logs and less frequently on soil in moist woods. Frequent in North America east of the Great Plains, less frequent in the Southern States, not yet reported from Florida; Minnesota, Iowa, New Mexico.

ILLUSTRATIONS:—Sull. Icon. Musc. *pl.* 91; M. H. M. *f.* 204a-d & 206.

EXSICCATI:—Drumm. Musc. Am. S. States 96 (as *Neckera*); Sull. Musc. Allegh. 77; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 260, (Ed. 2) 386; Macoun, Can. Musc. 263; Aust. Musc. Appal. 284; Grout, N. Am. Musc. Pl. 309, Musci Perfecti 165.

E. acicularis C. M. & Kindb. Macoun, Cat. Can. Pl. 6: 176 is only a peculiar form of *E. cladorrhizans*.

It has a peculiar brownish-green color, tips of branches lighter; branches short and turgid, larger in the middle and bearing there leaves as large as those on the stem; capsule and seta much shorter and teeth more perforate than is typical.

In the canyon at Tallulah Falls, Georgia, apparently in moist or muddy soil, Dr. John K. Small collected a form of this species with some of the stems stoloniferous and bearing rather narrowly lanceolate leaves, serrulate at the slender apex (no. 9331, April 1893).

2. ENTODON SEDUCTRIX (Hedw.) C. Muell. Linnaea, 19: 214. 1847.

Neckera seductrix Hedw. Sp. Musc. 208. *pl.* 47, *f.* 8-13. 1801.

Pterigynandrum carolinianum Brid. Musc. Recent. Suppl. 1: 132. 1803.

Plants in wide glossy yellow-green mats; stems about 5 cm. long, subpinnately branching; branches *julaceous*, 5-25 mm. long; branch leaves *imbricate-appressed*, oblong-elliptical to ovate, narrowed to the insertion, $\pm 1.2 \times 0.7$ mm., short-apiculate, with apiculation often reflexed, very concave; margins plane or slightly reflexed at base, entire or slightly serrulate at apex; costa short and double; median leaf cells linear, 6μ wide, 8-12 : 1; *quadrate alar cells numerous (10-20 on the margin) sometimes extending for $\frac{1}{4}$ the length of the leaf*; stem leaves larger, ovate, with rather broader cells; inner perichaetial leaves oblong-acuminate, serrulate at apex, somewhat plicate, with a thin costa. Seta about 1.5 cm. long, red-brown; capsule red-brown, 3-3.5 mm. long, 5-6 : 1, *cylindric, erect and symmetric*; operculum *conic-rostrate*; *annulus rather indefinite, of 2 to 3 rows of small cells, obscured by the base of the teeth and little differentiated*; peristome teeth subulate, short, 0.3 mm. long, very deeply inserted; *teeth with a very distinct median line, articulations close and irregular below but distant above, only 7-10 appearing above the mouth of the capsule; segments linear, about the length of the teeth*; spores autumn to winter. Type locality, Lancaster, Pennsylvania (Muhlenberg).

An exceedingly variable species and appropriately named.

ILLUSTRATIONS:—Hedw. l. c.; Sull. Icon. Musc. *pl.* 92; M. H. M. *f.* 204 & 205.

EXSICCATI:—Drumm. Musc. Am. S. States 97 (as *Neckera*); Sull. Musc. Allegh. 78; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 261, (Ed. 2) 387; Aust. Musc. Appal. 282, 283; Macoun, Can. Musc. 663; R. & C. Musc. Am. Sept. Exsic. 90; Grout, N. Am. Musc. Pl. 51, 173, 374.

On decaying wood, bases of trees, moist soil and stones, often in rather dry situations. Common from Ontario to the Gulf of Mexico, and from southern New England to southern Florida; west to Minnesota, Kansas and Texas.

Var. LANCEOLATUS Grout, Bull. Torr. Bot. Club 23: 226. 1896.

Stem leaves ovate-lanceolate, acute; branch leaves broadly lanceolate, tapering gradually to a serrate acute apex; median leaf cells 12 : 1; capsule about 8 : 1. On rotten wood, Hanging Rock, Wabash Co., Illinois, April 3, 1890. J. Schneek. This closely resembles *E. polysetus* C. Muell. from Brazil, which has even more slenderly pointed leaves and striolate teeth.

Var. MINOR (Aust.) Grout, l. c.

Entire plant much reduced, dirty green; leaves, seta and capsule shorter than in the type; capsules 1.5-2 mm. long, about 3 : 1. Type from Ohio (Sullivant). Also from Pennsylvania and Georgia. A portion of Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 388 in the Columbia Univ. Herbarium, issued as *Cylindrothecium compressum* is this variety.

Var. DEMETRII (R. & C.) Grout, l. c.

Cylindrothecium Demetrii R. & C. Rev. Bryol. 20: 14. 1893.

Stems irregularly divided and branched, strongly complanate-foliate, having almost exactly the appearance of *E. compressus*; leaves ovate, gradually acute, very entire in the type, often serrulate in other specimens. Capsule small, about 2 mm. long; peristome teeth often irregularly perforate. Type from stones at top of well, Emma, Saline Co., Missouri (Demetrio). Washington Co., N. Y. (Burnham).

In contrast to most Hypnaceae the most characteristic structure of this species is its peristome.

Judging from the figures, Hedwig's type of this species differs considerably from the plant figured by Sullivant; it has ovate leaves and rather short capsules. Sullivant figures an elliptical-oblong leaf and a much longer capsule. The plants corresponding to Hedwig's figures grow in places that are rather dry at times and its leaves are regularly and closely imbricated on the stout terete branches.

The plants corresponding to Sullivant's figures grow on rotten wood in more moist situations; the branches are more slender, the leaves less abruptly apiculate and less closely and regularly imbricate. Sullivant's figure of the mouth of the capsule shows it as it appears when first mounted but when cleared with glycerine 2 or 3 of the upper rows of cells show up as small annulus cells.

Var. *TENUIS* Grout, N. Am. Musc. Pl. 186. 1904.

Plants dark glossy green; stems and branches very slender; stems tapering into slender stolons; leaves ovate-lanceolate and slenderly acuminate as in var. *lanceolatus* but entire.

Queen's Bluff, Winona Co., Minnesota (Holzinger).

3. ENTODON COMPRESSUS (Hedw.) C. Muell. l. c. 707.

Leskea compressa Hedw. Sp. Musc. 232. pl. 56, f. 1-7. 1801.

Plants in thin dirty green mats, sometimes glossy yellow-green; stems and branches complanate-foliate and lying in the same plane, as in *E. cladorrhizans* but much more slender, leafy stems about 1 mm. wide; stems often much divided, subpinnately branching; leaves becoming appressed in drying, causing the plants to lose their complanate appearance to some extent; branch leaves oblong-ovate, ± 1.1 mm. long, 2 : 1, very concave, obtuse, with apiculation short or none, with few exceptions quite entire; costa short and double or lacking; median leaf cells linear, about 5μ wide, 8-12 : 1; basal cells much broader and shorter; alar cells quadrate (8-10 on the margin), extending almost to middle of leaf base; stem leaves larger, proportionally broader; perichaetial leaves long-sheathing, the inner oblong-lanceolate, very gradually acuminate, entire. Seta 0.7-1.5 mm. long; capsule brown, *elliptic to ovoid*, narrowed toward the mouth, 2.5×0.6 mm.; operculum conic-rostrate, with a slender inclined beak; annulus large, persistent; peristome 0.3-0.4 mm. long, teeth narrowly linear-lanceolate, *closely and regularly articulate, densely and minutely papillose*; segments linear, shorter than the teeth, minutely papillose; spores maturing in autumn. Type locality, Lancaster, Pennsylvania (Muhlenberg).

ILLUSTRATIONS:—Hedw. l. c.; Sull. Icon. Musc. pl. 93; M. H. M. f. 207.

EXSICCATI:—Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 264, (Ed. 2) 388 (mixed with *E. seductrix minor*).

On soil and rotting logs in the shade, also roots of trees near water. Rhode Island, New Jersey, Ohio, Illinois, Kansas, Nebraska, S. Dakota, Missouri; not common.

Easily distinguished when fruiting by its short capsules and long regularly articulate, papillose teeth.

4. ENTODON SULLIVANTII (C. Muell.) Lindb. Contrib. ad Fl. Crypt. As. Bor. Or. 233. 1872.

Neckera Sullivantii C. Muell. Syn. Musc. 2: 65. 1851.

Plants in rather thin glossy-green mats; stems 3-5 cm. long, irregularly divided, subpinnately branching; stems and branches slender, with leaves 1-1.5 mm. wide, narrower in xerophytic forms; branches 5-15 mm. long; branch leaves ovate-lanceolate, $\pm 1.1 \times 0.4$ mm., *acute and serrate at apex*, very concave, margins incurved; median leaf cells linear, 6μ wide, $\pm 8 : 1$; quadrate alar cells numerous, 8-10 on the margin and extending nearly or quite to costa at the insertion; costa short and double, strong for the genus; stem leaves much larger, 1.6 mm. long, broadly ovate-lanceolate, entire except at apex; inner perichaetial leaves oblong-ovate, long-acuminate, entire or serrulate at apex. Seta 1.5-2.5 cm. long, orange; capsule brown, cylindric, erect and symmetric, larger near base, with operculum 3.5-4 mm. long, 5-7 : 1; operculum conic-rostrate; annulus very large; peristome nearly 0.4 mm. long, with teeth linear-lanceolate, orange, *closely and regularly articulate, articulations more distant above and sections marked with irregular striolae which are vertical to oblique*, lower sections obscurely and horizontally striolate; segments a little shorter than the teeth, linear from a slightly wider base; spores in autumn. Type locality in woods along the French Broad River, N. Carolina (Sullivant).

ILLUSTRATIONS:—Sull. Icon. Musc. pl. 95; Pl. 43E.

EXSICCATI:—Sull. Musc. Allegh. (as *Leskea*); Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 263, (Ed. 2) 389; Grout, N. Am. Musc. Pl. 304.

On damp rocks in woods. N. Carolina, Tennessee, S. Carolina; Stone Mt., Georgia. Very rare. Also reported from Japan.

Resembling *E. compressus* but distinguished by its more slender stems and branches, serrate leaves, longer capsule and striolate peristome teeth.

5. ENTODON DRUMMONDII (Bry. Eur.) Jaeger & Sauerb. St. Gall. Nat. Gesell. 1876-77: 282.

Cylindrothecium Drummondii Bry. Eur. fasc. 46-47. 1851.

Neckera cladorrhizans Hook. & Wils. in Drumm. Musc. Am. S. States 96. 1841.

Plants in rather thin yellow-green mats; stems 4-8 cm. long, subpinnately branching; stems and branches complanate-foliate, lying in one plane; branches short, with leaves ± 2 mm. wide; branch leaves loosely imbricate, oblong-lanceolate to ovate-lanceolate, $1.8 \times 0.5-0.7$ mm., acute, serrate at apex, concave, nearly or quite ecostate; median cells linear-flexuose, 7μ wide, $15:1$, basal cells shorter and broader, rectangular to rhomboidal, quadrate alar cells 4-6 on the margin, extending nearly to middle of leaf base; stem leaves shorter and broader with more numerous enlarged and hyaline basal cells; inner perichaetial leaves oblong, long-acuminate with a few long spreading teeth at the apex. Seta 10-25 mm. long, bright yellow; capsule brown, erect and symmetric, cylindric, with operculum 2-2.5 mm. long, $4:1$; operculum long-conic to short-rostrate; mouth of capsule bordered by two or three rows of horizontally compressed cells and above these a row of enlarged cells without cavity, simulating annulus cells; peristome about 0.25 mm. long; teeth linear-lanceolate, smooth and hyaline above, striolate and often thicker, brown, and perforate below; segments linear, nearly or quite as long as the teeth; spores apparently maturing in spring. Type locality, Louisiana (Drummond).

ILLUSTRATIONS:—Sull. Icon. Musc. pl. 94; Pl. 43D.

EXSICCATI:—Drumm. Musc. Am. S. States 96 (type); Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 264, (Ed. 2) 390; Aust. Musc. Appal. Suppl. 558; R. & C. Musc. Am. Sept. Exsic. 91; Grout, N. Am. Musc. Pl. 245. Macoun's Can. Musc. 436 is not this species.

On rocks base of trees and logs in moist woods; southern U. S. east of the Mississippi, north to Tennessee and N. Carolina; also in northern Mexico.

Distinguished at sight by the very wide flattened branches and yellow seta.

6. ENTODON BREVISETUS (Hook. & Wils.) Jaeger & Sauerb. l. c. 291.

Neckera breviseta Hook. & Wils. Lond. Jour. Bot. 4: 489. pl. 24, f. a. 1842.

Plants in wide densely intricate mats, dark green below, young growth lighter; stems varying greatly in length, averaging about 5 cm., creeping, subpinnately branching; branches short, suberect, abruptly tapering at the end; leaves closely imbricate when dry; branch leaves lanceolate, 1.9×0.6 mm., gradually and narrowly long-acuminate, entire or slightly serrulate at apex, concave, narrowed to the insertion; costa double, extending nearly $\frac{3}{4}$ the length of the leaf; median leaf cells linear-fusiform to oblong-hexagonal, $\pm 7 \mu$ wide, $6:1$; basal cells rectangular, alar quadrate (extending up the margin in a narrow band $\pm \frac{1}{4}$ the length of the leaf) chlorophyllose; stem leaves larger, ovate-lanceolate; inner perichaetial leaves oblong-lanceolate, long-acuminate, entire. Seta 1-2 cm. long, light reddish brown; capsule brown, 2.5-3 mm. long, $5:1$, ovoid-cylindric, contracted below the mouth when dry and empty; operculum long-conic, obtuse; annulus large; peristome teeth linear-lanceolate, reddish brown, closely and regularly articulate, bordered the entire length by the adherent segments as in *Pylaisi Selwynii*; spores in autumn. Type locality near St. Louis, Missouri (Drummond).

ILLUSTRATIONS:—Hook. & Wils. l. c.; Sull. Icon. Musc. pl. 96; Pl. 43B.

EXSICCATI:—Drumm. Musc. Am. S. States 95 (the type); Sull. Musc. Allegh. 79; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 265, (Ed. 2) 391; Grout, N. Am. Musc. Pl. 184, 303; Aust. Musc. Appal. 285.

On base of trees, limestone rocks and soil, apparently more or less calcicolous. New Brunswick, New Jersey, Pennsylvania, Virginia, Ohio, Missouri; rare.

This species is readily distinguished from all our others by its narrowly acuminate leaves and adherent segments of the inner peristome. The archegonia and antheridia seem to have a tendency to appear in alternate seasons on the same plants.

On the bark of trees in the mountains of North Carolina there are forms with long slender stoloniferous stems, bearing very narrow slender leaves that are most unlike the normal forms.

7. ENTODON ORTHOCARPUS (La Pyl.) Lindb. Musc. Scand. 39. 1879.

Hypnum orthocarpum La Pylaie in Brid. Bryol. Univ. 2: 422. 1827.

Cylindrothecium Montagnei Bry. Eur. fasc. 46-47. pl. 465. 1851.

Cylindrothecium concinnum Schimp. Syn. 515. 1860.

Plants in wide loosely intricate yellowish-green tufts; stems 2–10 cm. or more long, suberect, pinnately branching; stems and branches terete to somewhat complanate-foliate, rigid; branches about 1 cm. long, tapering; branch leaves oval-oblong, 1.2 x 0.6 mm., obtuse, entire, very concave, with involute margins above, ecostate or shortly bicostate; median leaf cells linear-flexuose, about 7 μ wide, 10–15 : 1, growing broader and shorter toward the apex; basal shorter and broader, rectangular, incrassate and pitted; at basal angles quadrate (10–15 on the margin) thin-walled and in two or three layers; stem leaves larger and relatively broader, with median cells longer and narrower. Dioicous; sporophyte not yet found in N. America; seta 1.5–2 cm. long; capsule brown, erect, cylindric, symmetric, 3 mm. long, 5 : 1; operculum conic-rostrate, with beak often oblique; annulus present, of 2–3 rows of small cells; peristome teeth linear-lanceolate, red-brown and closely articulate above, often perforate or split along the median line; segments linear, as long as the teeth; spores in autumn. Type locality, France.

ILLUSTRATIONS:—Bry. Eur. l. c.; Husnot, Musc. Gall. *pl.* 89; *Pl.* 41.

Very rare; Newfoundland, Colorado, New Mexico.

Resembling *Calliargon Schreberi* in appearance but the stems are not red and the basal and angular cells are less distinct and not hyaline or orange and the alar cells are in more than one layer. Whenever present the capsules are very distinctive.

2. HOLMGRENIA Lindb. Oefv. Vet.-Ak. Förh. 19: 605. 1863.

Orthothecium Bry. Eur. fasc. 48. 1851. Not Schott & Endl. Melet. Bot. 31. 1832.

Plants in wide glossy bright-colored mats (or scattered among other mosses); primary stems irregularly divided, sparsely branching; paraphyllia lacking; leaves erect, not decurrent, usually entire, or sometimes slightly serrulate, acuminate, concave; costa short and double or lacking; median leaf cells linear, basal shorter and broader, alar little differentiated. Sporophyte rare; seta long and smooth, calyptra small fugacious; capsule nearly or quite erect and symmetric; operculum conic; annulus large; peristome double, teeth and segments lanceolate, the latter from a broad basal membrane; cilia single, usually short or lacking.

KEY.

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|--|------------------------|
| 1. Plants large; stems 5–10 cm. long; leaves strongly plicate..... | 1. <i>chrysea</i> . |
| Plants small; stems 2–4 cm. long; leaves not plicate..... | 2. |
| 2. Leaves ovate- to ovate-lanceolate..... | 3. |
| Leaves narrowly lanceolate..... | 2. <i>intricata</i> . |
| 3. Leaf margins strongly revolute; peristome without cilia..... | 3. <i>stricta</i> . |
| Leaf margins plane..... | 4. |
| 4. Leaves broadly ovate, abruptly short-acuminate to apiculate; sporophyte unknown. | 5. <i>acuminata</i> . |
| Leaves ovate to ovate-lanceolate, gradually acute to acuminate; peristome with single cilia..... | 4. <i>diminutiva</i> . |

1. HOLMGRENIA CHRYSSEA (Schwaegr.) Lindb. l. c.

Hypnum chryseum Schwaegr.; Schultes, Reise auf d. Glockner 2: 364. 1804.

Plants in thick glossy golden tufts; stems 5–10 cm. long, erect to ascending, simple or sparingly divided; leaves imbricate, not complanate or secund, ovate-lanceolate to triangular-ovate, 1.3–2 x 0.4–0.8 mm. (Limpricht says 2.5–3.3 long), apiculate to short-acuminate, concave, strongly plicate, nearly or quite ecostate; margins entire, recurved; median leaf cells linear, 6 μ wide, 12–14 : 1; basal somewhat shorter and broader, thick-walled and golden brown; perichaetial leaves triangular-ovate, the inner long-acuminate, sharply toothed above, not plicate. Dioicous; seta golden-brown, 2–3 cm. long; capsule ovoid-cylindric, often slightly unsymmetric, contracted under the mouth when dry and empty; operculum conic; annulus of 2 rows of cells; peristome perfect, with rather short cilia; spores spring to early summer. Type locality European.

ILLUSTRATIONS:—Bry. Eur. *pl.* 461; *Pl.* 41.

EXSICCATI:—N. Am. Musc. Pl. Suppl. 18.

On moist rocks and stony slopes, in alpine or boreal regions. Rare and seldom fruiting. Rocky Mts., Saskatchewan, Montana, Colorado.

2. HOLMGRENIA INTRICATA (Hartm.) Lindb. l. c.

Leskea intricata Hartm. Skand. Fl. (Ed. 5) 336. 1849.

Plants in wide densely intricate mats, of various shades of green, dark, brownish, yellowish or reddish; stems filiform, 2–4 cm. long, creeping, somewhat stoloniferous, irregularly divided; branches short and erect or elongated and prostrate; leaves equally appressed-imbricate to somewhat secund, narrowly lanceolate, 0.8–2.5 x 0.2–0.45 mm., subulate to long filiform-acuminate, *entire*, somewhat concave, *not plicate*, ecostate *with plane margins*; median leaf-cells linear, 6 μ wide, 8–10 : 1; basal cells shorter and broader, often colored a red-brown; alar not differentiated; inner perichaetial leaves lanceolate, long filiform-acuminate. Dioicous; seta 1.5–2 cm. long; capsule erect and symmetric, red-brown, oblong-ovoid, about 2 mm. long; operculum conic; annulus present; peristome teeth closely and regularly articulate; segments from a narrow basal membrane, linear, perforate, longer than the teeth; cilia lacking. Type locality European.

ILLUSTRATIONS:—Bry. Eur. *pl.* 462; *Pl.* 41.

On rocks around Kicking Horse Lake, Rocky Mts. (Macoun), near New Denver, British Columbia, (MacFadden); Owen Sound, Ontario (Moxley).

Both European and American plants vary greatly in size and in the length of leaf acumination. The high alpine form known as var. *sericea* (Bry. Eur.) is much more slender with smaller leaves represented fairly well in figure 8 of the Bry. Eur. illustration in *Pl.* 41. Mrs. MacFadden's plant is close to this variety.

The margins on some of the leaves of undoubted *intricata* are sometimes more or less revolute in both European and American plants. This inclines the author to the belief that Husnot is right in calling the next a variety of *intricata*, even though Limpricht considers it more closely allied to *H. chrysea*.

3. HOLMGRENIA STRICTA Lorentz, Moosstud. 122. *pl.* 5. 1864.

Stereodon rubellus Mitt. Jour. Linn. Soc. 8: 40. 1865.

Plants small, cespitose, orange, glossy; secondary stems erect to ascending, sparingly branched; lower branch leaves elongated ovate, upper erect-imbricate, ovate-lanceolate, 1 x 0.3–0.4 mm., *not plicate or sulcate*, ending in a short flexuose subhyaline acumination; *margins revolute, serrulate above*; costa short and double; median leaf cells oblong-linear, \pm 8 μ wide, 6–8 : 1; basal cells shorter, brownish yellow, alar not strongly differentiated; stem leaves larger, 1–1.4 mm. long with shorter acumination. Dioicous; perichaetial leaves ovate-lanceolate. Sporophyte lacking. Type locality, the Alps. *Pl.* 41.

Davis Strait (Taylor, a ship's surgeon, not Dr. T. Taylor whose herbarium is at Harvard). Rocky Mountains (Macoun).

Mitten says of his *Stereodon rubellus*: "A small moss with the habit, appearance and color of *Orthothecium intricatum* Br. & Sch. but differing in its almost exactly ovate leaves, with a short sometimes discolored apiculus, the margin revolute, and the areolation composed of cells which are twice as wide."

The author has seen Mitten's type. The leaves are as described, while the European form is described as having ovate-lanceolate leaves. Husnot's fig. 10 in the illustration of *H. intricata* shown in *Pl.* 41 as illustrating its var. *binervulum* represents the outline of the leaf in Mitten's plant fairly well. The figures 7–9 represent Husnot's idea of *H. stricta*.

4. HOLMGRENIA DIMINUTIVA n. sp.

Plantae pertenuis; caulis paululum ramosus, circa 1–2 cm. longus; folia circa 0.6 mm. longa, erecto-patentia, quandoque secunda, ovata, sensim brevi-acuminata vel acuta, concava. Capsula erecta, oblongo-cylindrica, peristomio perfecto. A *H. intricata* distinguitur, foliis brevioribus, brevius acuminatis, peristomii ciliolis singulis.

Somewhat resembling depauperate *H. intricata*; stems very slender, ascending, a little branched, 1–2 cm. long; cortical cells large and thin-walled; leaves close, erect-spreading, somewhat secund, ovate to ovate-lanceolate, narrowed and rounded to the insertion, *gradually acute to acuminate*, concave, nearly or quite entire, ecostate or nearly so, about 0.6 mm. long; median leaf cells linear-flexuose, about 5–6 μ , 8–12 : 1; basal shorter, alar little differentiated; perichaetial leaves longer, *more abruptly short-acuminate*. Seta slender, 1.5–2 cm. long; capsule nearly erect and symmetric, oblong to cylindric, urn about 1.5 mm. long; *peristome perfect hypnaceous with well-developed single cilia*; base of teeth marked with fine transverse lines.

Type from Tolland, Colorado, July, 1913. Type in herb. A. J. G. and cotype in herb. Dixon.

In a mixed tuft of *Pohlia*, and *Drepanocladus uncinatus* var. on the bank of a creek about 7000 ft. elevation.

Mr. Dixon thinks the leaf characters not inconsistent with a variety of *H. intricata* but the shorter and much less slenderly acuminate leaves considered in connection with the well-developed single cilia in the peristome seem to the author to indicate a specific difference.

5. HOLMGRENIA ACUMINATA (Bryhn) n. comb.

Orthothecium acuminatum Bryhn, Bryophyta in Itinere Polari Norvagorum secundum Collecta, Kristiana, 1906.

Plants exceedingly slender (leafy stems about 0.5 mm. wide), golden-green above, brownish below; stems julaceous, reaching 3-4 cm. in length, sparingly divided, often giving off slender stoloniferous branches bearing minute leaves, leaves closely appressed-imbricate, round-ovate to oblong-ovate, abruptly very short-acuminate, 0.6-0.8 mm. long, slightly serrulate above; median leaf cells oblong to oblong-rhombic, about $9 \times 35-45 \mu$; basal shorter, incrassate and deeply colored, obscure, alar scarcely differentiated.

Sporophyte unknown. Type from King Oscar Land, July, 1901, $76^{\circ} 40'$ (H. G. Simmons, no. 3228) again collected $76^{\circ} 30'$, June, 1901 (no. 2786). Also at Ellesmere Land, Bedford Pine Island, July, 1899 (no. 1183). These specimens collected on the voyage of the Fram were communicated by Dr. Johannes Lid of the Botanical Museum at Oslo.

Family LESKEACEAE.

Mosses of varying habit and size, growing on shaded earth, stones, trunks of trees or decayed wood, usually lusterless; main stems creeping with ascending or erect secondary stems. In *Thuidium* the stems are regularly pinnately branched and ascending, having somewhat the appearance of miniature ferns; central strand rudimentary or lacking in most cases. Stem leaves often very different from the branch leaves, both strongly costate in most species; costa not excurrent; leaf cells rarely more than 3 : 1, often less, mostly papillose, papillae often large; leaf cells of the basal portion of the leaf more elongated and less strongly papillose, often smooth. Paraphyllia present in most species, often abundant, varying in form but mostly slender and branched. Seta long and smooth (except *T. involvens*). Capsules erect and symmetric in most of our species except in the *Thuidieae*. The *Thuidieae* also have the perfect hypnaceous peristome, but most of the other species illustrate well the degeneracy of the peristome in erect capsules as explained in M. H. M. p. 28; in these the cilia are usually vestigial or lacking and the segments often very narrow, or, in some cases, imperfect.

The text in the treatment of this family is largely based on the excellent monographs of the principal genera published several years ago in the Bulletin of the Torrey Botanical Club by the late Dr. George N. Best.

(A key to the genera of the entire family will be given at the end of this family.)

Subfamily THUIDIEAE.

Stems rather stiff; branching irregular to regularly pinnate and complanate; capsules inclined, unsymmetric; peristomes perfect with well-developed cilia and horizontal striae on the external basal plates of the peristome teeth.

KEY TO GENERA.

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|---|---------------------------|
| 1. Costa poorly developed, short and thin or lacking..... | 4. <i>Heterocladium</i> . |
| Costa well developed, often percurrent..... | 2. |
| 2. Paraphyllia scale-like or wanting..... | 3. <i>Cladopodium</i> . |
| Paraphyllia filamentous, usually abundant..... | 3. |
| 3. Apical cells of branch leaves with 1-4 papillae; stem leaves without paraphyllose filaments at base..... | 1. <i>Thuidium</i> . |
| Apical cells of branch leaves without papillae; stem leaves with paraphyllia-like filaments at base..... | 2. <i>Helodium</i> . |

1. THUIDIUM Bry. Eur. fasc. 49-51. 1852.

Plants slender to robust, mostly stiff, in greenish, yellowish or brownish cushions; stems creeping, ascending or erect, pinnately branched, often regularly and in one plane; branches simple, pinnate or bipinnate; stem and branches more or less thickly covered slender simple or branched paraphyllia; stem leaves often quite different from the branch leaves, ovate-triangular to oblong-lanceolate, acuminate,

cordate, plicate, strongly costate, papillose on one or both surfaces; branch leaves smaller, ovate to ovate-lanceolate; both stem and branch leaves erect-spreading to open-erect when moist, when dry incurved or appressed but never secund. Capsules oblong-cylindric, unsymmetric, suberect to pendulous; annulus large; peristome perfect, with well-developed cilia and a broad basal membrane fully $\frac{1}{2}$ the length of the teeth; operculum from short-conic to long-rostrate. Type species *T. tamariscinum* (Hedw.) Bry. Eur.

KEY.

- | | |
|--|---------------------------|
| 1. Apical cell of branch leaves crowned with 2-4 papillae..... | 2. |
| Apical cells of branch leaves with a single terminal papilla..... | 10. |
| 2. Paraphyllia numerous, more or less branched..... | 3. |
| Paraphyllia few, small, mostly linear-oblong, 2-6 cells long..... | 8. |
| 3. Stems closely once pinnate, branches subjulaceous when dry..... | 4. |
| Stems loosely pinnate; branches pinnate to bipinnate..... | 5. |
| 4. Plants comparatively soft; leaf cells with 2-5 small papillae on each surface..... | 5. <i>scitum</i> . |
| Plants rigid; leaf cells with a single papilla on each surface..... | 6. <i>abietinum</i> . |
| 5. Stem leaves spreading-recurved, margins plane, costa percurrent; perichaetial leaves not ciliate; apparently calcicolous..... | 4. <i>recognitum</i> . |
| Stem leaves erect-spreading, margins recurved, costa vanishing below apex..... | 6. |
| 6. Stem leaves usually with a hyaline filiform acumination..... | 2. <i>Philiberti</i> . |
| Stem leaves acute to acuminate, not hyaline at apex..... | 7. |
| 7. Perichaetial leaves ciliate; plants very regularly bi- tri-pinnate..... | 1. <i>delicatulum</i> . |
| Plants less regularly bipinnate; perichaetial leaves not ciliate..... | 3. <i>Alleni</i> . |
| 8. Subtropical only; seta rough throughout..... | 7. <i>invovens</i> . |
| Found from Canada southwards; seta smooth..... | 9. |
| 9. Plants very small, 1-2 cm.; stem and branches filiform, branches papillose..... | 9. <i>pygmaeum</i> . |
| Plants small, 2-4 cm.; branches smooth..... | 8. <i>minutulum</i> . |
| 10. Stem leaves roundish-ovate, abruptly acuminate to a broad oblong point; margins erose-serrate..... | 11. <i>virginianum</i> . |
| Stems leaves rather gradually long-acuminate; margins crenulate-serrate or entire. | 10. <i>microphyllum</i> . |

1. THUIDIUM DELICATULUM (L., Hedw.) Mitt. Jour. Linn. Soc. 12: 578. 1869.

Hypnum delicatulum Hedw. Sp. Musc. 260. 1801.

Plants large, in intricate spreading mats, bright green or yellowish above, darker below; stems 5-10 cm. long, ascending, often arched; branching *regularly twice or three times* pinnate; paraphyllia very numerous, multiform; *stem leaves appressed when dry, erect-spreading when moist*, sulcate, triangular-ovate, subcordate at base, rather gradually acuminate, about 1 mm. long; *costa gradually becoming thinner and vanishing in the apex*; margins papillate-serrate, recurved; leaf cells unipapillate on both sides, occasionally bipapillate, rather thick-walled, oblong-quadrate to oval-rhombic, 7-8 μ wide, 1-3 : 1; branch leaves smaller, ovate, acuminate, the apical cells with 2-4 papillae; inner perichaetial leaves more or less ciliate on the margins, the loriculate-filiform serrate acumination about twice as long as the blade. Dioicous; seta 2-3 cm. long, stiff, chestnut in color; capsule cylindric-arcuate, inclined to horizontal; annulus large; operculum conic-rostrate; spores late autumn to winter. Type localities, "Pennsylvania, Maryland and Virginia."

On soil, rotten wood and stones in moist shaded places. Common from Labrador to British Columbia, southward in the U. S. to the Gulf, rare or lacking on the Pacific coast.

ILLUSTRATIONS:—M. H. M. f. 128, f. 122b and pl. 52, f. 7; Grout, Mosses with H-lens pl. 51 & 52; Jennings, Mosses of Western Pa. pl. 36.

EXSICCATI:—Drumm. Musc. Bor. Am. 213, S. States, 136; Sull. Musc. Allegh. 3 (as *Hypnum tamariscinum*); Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 272, (Ed. 2) 403; Aust. Musc. Appal. 302; Grout, N. Am. Musc. Pl. 76, 76a, 300.

*2. THUIDIUM PHILIBERTI Limpr. Laubm. 2: 835. 1895.

Thuidium intermedium Philib. Rev. Bryol. 20: 33. 1893. Not of Mitten, Jour. Bot. & Kew Misc. 3: 353. 1851; and Jour. Linn. Soc. 12: 573. 1869.

A poorly delimited subspecies of *T. delicatulum*; stem leaves usually with a hyaline filiform acumination, composed of a single row of 3-8 linear cells; perichaetial leaves looser, more spreading and flexuose, slender

acumination nearly three times as long as the body of the leaf in the inner leaves, rarely with a few short cilia; annulus narrow or indistinct. Type locality, France.

ILLUSTRATIONS:—Bull. Torr. Bot. Club 23: pl. 260; Pl. 44.

In wet swampy places, on the ground or at the base of small trees. New Jersey (Best); Pennsylvania (Porter); New Mexico (Holzinger).

3. THUIDIUM ALLENI Aust. Bull. Torr. Bot. Club 7: 16. 1880.

Thuidium glaucinum (Mitt.) Borch. & Lac. var. *ludovicianum* Card. Bryol. 8: 51. 1905.

Plants in rather thick loose wide mats; stems erect to ascending, bipinnately branching but much less regularly so than in *T. delicatulum*, densely paraphyllose; stem leaves rather distant, incurved when dry, spreading when moist, broadly ovate, shortly and broadly acuminate, acute or obtuse, rarely more slenderly acuminate, concave, with recurved margins ("bisulcate"), narrowed and rounded to the insertion; margins crenulate-papillose, otherwise entire; costa strong, ending below the apex; median leaf cells oblong to rounded-quadrate, thick-walled, about $7\ \mu$ wide, 1-2 : 1, *each with one or more comparatively low papillae on each face*; basal cells somewhat longer; paraphyllia few or none on branches and branchlets; *branch leaves broadly ovate, not acuminate, acute to obtuse*, very concave, with plane margins, leaves of branchlets similar but smaller; *perichaetial leaves not ciliate*. Mature sporophytes unknown. Pl. 42. N. Am. Musc. Pl. 398 and Suppl. 9.

Dr. Best in a letter dated May 13, 1906, accepts *T. Alleni* as a good species and states that he has it from Pennsylvania, Virginia, S. Carolina and Georgia. He also stated that Cardot's plant from Louisiana is the same thing and on one of these plants he found the non-ciliate perichaetial leaves. He further stated that *T. Alleni* "while resembling *T. glaucinum*, differs in several respects, more especially in the papillae, which in the latter are spinulose."

The type from Connecticut seems to represent the northern range of the species. In it the stem leaves seem to be less incurved than in the Florida plants, but Austin in his original description says "*foliis siccis crispatis*." This is well shown in Pl. 42, f. 5.

T. Alleni is abundant in certain localities in Florida and is easily distinguished in the field from *T. delicatulum* (which is also frequent) by its less regular branching and more scraggly appearance. Under the microscope the low papillae are very distinctive. The stem leaves are occasionally as long-acuminate as in most *T. delicatulum*.

4. THUIDIUM RECOGNITUM (Hedw.) Lindb. Not. Sällsk. pro Fauna et Flora Fenn. 13: 416. 1874.

Hypnum recognitum Hedw. Sp. Musc. 261. 1801.

Hypnum protensum Mx. Fl. Bor. Am. 2: 317. 1803.

Thuidium delicatulum Bry. Eur. fasc. 49-51. pl. 484. 1852 (not of Linn.).

Very close to *T. delicatulum* and confused with it by many authors and students. Distinguished as follows: rarely if ever tripinnate; branches more uniform in length, making the ends of the fronds oblong, leaves rather more crowded at the ends of the stems, *spreading-recurved* when dry, broadly triangular, more abruptly acuminate; margins usually plane; *costa percurrent, strong and thick, often even to the very tip of the leaf*; perichaetial leaves with the narrow acumination about as long as the body of the leaf, not ciliate; capsule as a rule more narrowly cylindrical. Type locality, Saxony. Type in the Boissier Herbarium at Geneva.

ILLUSTRATIONS:—Bry. Eur. l. c.; Jennings, l. c.; M. H. M. f. 127 & pl. 52, f. 8.

EXSICCATI:—Drumm. Musc. Am. 214; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 273 (as *Hypnum delicatulum*), (Ed. 2) 404; Aust. Musc. Appal. 303; Grout, N. Am. Musc. leaf. 77.

On soil, rotten wood and stones in moist shaded woods in limestone regions. Labrador to British Columbia, southeast to Florida? Much less frequent than *delicatulum*, rare or absent on the Pacific slope.

On one of the perichaetial leaves of Musc. Bor. Am. 273, which is otherwise characteristic *recognitum*, I found a much branched structure, more like paraphyllia than cilia.

5. THUIDIUM SCITUM (P. B.) Aust. Musc. Appal. 51. 1870.

Hypnum scitum P. B. Prod. 69. 1805.

Plants in thin appressed mats, green to yellow-brown below; stems 4-6 cm. long, prostrate, simple or divided, *densely pinnately branched*; branches 2-3 mm. long, simple, terete when dry; paraphyllia multiform, mostly linear; stem leaves broadly *cordate-deltoid*, 0.5-0.6 mm. long, long and narrowly acuminate, bisulcate; margins plane, finely papillose-denticulate; costa broad, pellucid, vanishing in the base of the acumination; median leaf cells rounded-hexagonal, $6\ \mu$ in diameter, incrassate, obscure, *pluripapillate* (3-6); middle basal oblong; branch leaves smaller, broadly ovate-acuminate; inner perichaetial leaves erect long filiform-

acuminate. Monoicous; seta about 1.5 cm. long; capsule oblong-cylindric, straight or slightly curved, erect or inclined; annulus large; operculum conic-rostrate; peristome perfect; spores in autumn or early winter. Type locality North American. Type in the Delessert Herbarium, Geneva.

ILLUSTRATIONS:—Sull. Icon. Musc. *pl. 99*; Jennings, Mosses W. Pennsylvania *pl. 35*; *Pl. 44*.

EXSICCATI:—Sull. Musc. Allegh. 6; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 276, (Ed. 2) 409; Aust. Musc. Appal. 300; Grout, N. Am. Musc. Pl. 135.

On roots and bases of trees, more rarely on soil or stones; Ontario to Wisconsin and Missouri, eastward to the Atlantic Ocean and south to N. Carolina and Georgia.

Var. *AESTIVALE* Aust. Musc. Appal. 301. 1870. Stems more diffusely divided, less densely pinnate; perichaetial leaves more abruptly filiform-acuminate; capsule curved, horizontal, wide-mouthed; operculum more abruptly rostrate with shorter beak; spores in summer. With the range of the species in the main.

6. THUIDIUM ABIETINUM (L., Brid.) Bry. Eur. fasc. 49-51. *pl. 485*. 1852.*

Hypnum abietinum Brid. Musc. Rec. 2^o: 80. 1801.

Plants about the size of *delicatulum*, yellowish-green at the tops, darker and brownish below, growing in dense tufts or mats; stems 5-10 cm. long, ascending-erect, stiff, closely and regularly pinnately branched; branches simple, unequal, slender, attenuate, terete when dry; paraphyllia multiform, mostly linear; stem leaves crowded, broadly ovate, acuminate, 0.9-1.2 mm. long, deeply biplicate; margins papillate-serrulate; costa strong, reaching $\frac{3}{4}$ the length of the leaf or beyond; median leaf cells oval-rhombic, unipapillate, reaching 10 μ wide; quadrate-hexagonal and smaller at the basal angles; branch leaves similar but smaller, apical cell usually with two papillae, sometimes only one; inner perichaetial leaves slender, gradually attenuate, plicate, without cilia. Dioicous; seta 1.5-3 cm. long; capsule narrowly cylindrical, suberect, curved, with an evident neck; operculum long-conic, acute; annulus large; peristome perfect; spores in spring, infrequently produced. Type locality European.

ILLUSTRATIONS:—Bry. Eur. l. c.; *Pl. 37*.

EXSICCATI:—Drumm. Musc. Am. 216; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 280; Aust. Musc. Appal. 394; Grout, N. Am. Musc. Pl. 43.

On rocks, stones and soil in dry sterile places, often among grass and herbage. Greenland to Virginia, west to British Columbia and Alaska. Fruiting in Montana, Colorado and Alaska, sterile elsewhere.

Dixon states that the branches are in two rows in two planes but that is not evident in the plants studied.

7. THUIDIUM INVOLVENS (Hedw.) Mitt. Jour. Linn. Soc. 12: 575. 1869.

Leskea involvens Hedw. Stirp. Crypt. 4: 37. *pl. 11*. 1797; and Sp. Musc. 218. 1801.

(The synonymy given by Paris in the second edition of the Index Bryologicus is not quoted here because of its somewhat doubtful character.)

Plants relatively small and slender for the genus, growing in thin loose dark-green mats; stems 2-4 cm. long, creeping, pinnately branched, branches 2-5 mm. long; paraphyllia few, apparently found on the stems only, linear; leaves erect-spreading, curved inward and almost crisped when dry; stem leaves ovate-lanceolate, slenderly acuminate, reaching 0.6 mm. in length, entire, with costa reaching to base of acumination; branch leaves subdistichous, unsymmetric, the lower oblong-ovate and acute, often a little larger than the stem leaves, the upper oblong and almost rounded at the apex, somewhat concave with the lower margin more or less reflexed; costa nearer the lower margin, ending well below the apex; leaf cells papillose, each with several small papillae, irregularly quadrate to subhexagonal, about 10 μ in diameter, little different at base of leaf; inner perichaetial leaves long filiform-acuminate from an ovate base, acumination appearing subserrulate by projecting cell walls, costa percurrent. Seta 10-15 mm. long, dark red, strongly and closely papillose; capsule ovoid, unsymmetric, inclined to drooping, urn about 1.2 mm. long, operculum rostrate, about $\frac{2}{3}$ the length of the urn; annulus present; peristome perfect; spores in autumn. Type locality, Jamaica, W. I.

ILLUSTRATIONS:—Hedw. l. c.; *Pl. 42*.

EXSICCATI:—Grout, N. Am. Musc. Pl. 483 is mostly *Mittenothamnium diminutivum* (Hampe.) E. G. B. Some specimens contain *T. minutulum* and others a little *T. involvens*.

On logs and bases of trees; Florida from Sanford southwards, apparently rare.

*See Best in Bryologist 8: 17. 1905.

8. THUIDIUM MINUTULUM (Hedw.) Bry. Eur. fasc. 49-51. *pl.* 481. 1852.

Hypnum minutulum Hedw. Stirp. Crypt. 4: 90. *pl.* 34. 1797; Sp. Musc. 260. 1801.

Plants small but a little larger than *T. pygmaeum*, in thin dark green mats; stems 2-4 cm. long, creeping, pinnately branched, stems and branches smooth, bearing a few simple linear paraphyllia, 3-6 cells long; stem leaves distant, triangular-ovate, acuminate to apiculate, 0.6-0.8 mm. long; margins papillose-crenulate, somewhat revolute below; costa strong, ending near the apex; leaf cells irregularly polygonal to quadrate-hexagonal, about 9 μ in diameter, marginal larger, all thick-walled and pluripapillose; branch leaves ovate-acuminate, about 0.2-0.3 mm. long, concave with a shorter costa; perichaetial leaves erect, slenderly long-acuminate, entire. Monoicous; seta 2-2.5 cm. long, slender; capsule yellowish, about 3 mm. long including operculum, oblong-ovoid, unsymmetric, inclined to horizontal, rough; operculum rostrate; peristome perfect, cilia usually 2; annulus large; spores in autumn. Type locality, Lancaster, Pennsylvania, Muhlenberg.

ILLUSTRATIONS:—Hedw. l. c.; Bry. Eur. l. c.; Jennings, Mosses W. Pa. *pl.* 35; M. H. M. *pl.* 52 & f. 123; *Pl.* 37.

EXSICCATI:—Drumm. Musc. Am. S. States, 137; Sull. Musc. Allegh. 4; Sull. & Lesq. Musc. Bor. Am. (Ed. 2) 137; Austin, Musc. Appal. 297; Grout, N. Am. Musc. Pl. 235, 270.

On rotten wood and bases of trees, frequently on earth and stones, especially in the southern range. New Brunswick to Minnesota, south to Florida and Mexico, not rare.

9. THUIDIUM PYGMAEUM Bry. Eur. fasc. 49-51. Mon. 6. 1852.

Plants very small, dark dull green in thin felted mats; stems 1-2 cm. long, creeping, pinnately branched; branches pinnate, capillary, papillose; paraphyllia simple, short, 2-5 cells long, easily overlooked; stem leaves distant, triangular-ovate, narrowly acuminate, median leaf cells quadrate-hexagonal, 6 μ wide, pluripapillate; branch leaves 0.15 mm. long, ovate, obtuse, appressed-incurved when dry; costa ending below the apex. Monoicous; seta 1-1.5 cm. long; capsule oblong, unsymmetrical, inclined to horizontal, wide-mouthed; operculum conic, obliquely rostrate; annulus large; peristome perfect; spores in autumn. Type locality, Columbus, Ohio (Sullivant). Type at Kew in Herb. Schimper.

ILLUSTRATIONS:—Sull. Icon. Musc. *pl.* 98; *Pl.* 44.

EXSICCATI:—Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 275, (Ed. 2) 408; Aust. Musc. Appal. 296.

On stones, rarely on soil in calciferous regions. New Jersey, Pennsylvania, Ohio; Canada.

10. THUIDIUM MICROPHYLLUM (Sw., Hedw.) Best, Bull. Torr. Bot. Club 23: 87. 1896.

Hypnum microphyllum Sw. Prod. 142. 1788; and Hedw. Sp. Musc. 269. 1801.

Hypnum gracile Br. & Sch. Lond. Jour. Bot. 2: 668. 1843 (name only). Also C. Muell. Syn. 2: 488. 1851.

Hypnum calyptratum Sull. Pacific R. Rep. 4: 190. *pl.* 10. 1856.

Plants in rather thin spreading mats, medium-sized for the genus, light to yellowish-green, darker with age; stems 3-5 cm. long, with branching rather regularly pinnate; paraphyllia multiform; stem leaves broadly ovate to ovate-lanceolate, gradually long and narrowly acuminate, 0.75 to 1.2 mm. long, concave, biplicate; margins sinuate-serrulate or entire, plane or revolute; costa almost percurrent; median leaf cells quadrate-oblong to oval-rhombic, often hexagonal, rather thick-walled, the apical and a few of the basal more elongated, unipapillate with blunt papillae; branch leaves smaller, less slenderly acuminate; inner perichaetial leaves long-sheathing and long-acuminate, reaching 2.5 mm. in length, costate. Monoicous; seta reaching 2-2.5 cm. in length; capsule oblong, curved and inclined to drooping, about 2 mm. long, chestnut; operculum conic-apiculate or obtuse; annulus present; peristome perfect; spores in summer. Type locality, Jamaica (Swartz); type in Herb. Boissier.

ILLUSTRATIONS:—Hedw. l. c. *pl.* 69, figs 1-5; Sull. Icon. Musc. *pl.* 100; Jennings, Mosses W. Pa. *pl.* 35; M. H. M. *pl.* 55.

EXSICCATI:—Drumm. Musc. Am. 217, S. States 140-141; Sull. Musc. Allegh. 5; Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 277, (Ed. 2) 410; Aust. Musc. Appal. 298; Grout, N. Am. Musc. Pl. 234.

On rotten wood, bases of trees, stones and soil. Vancouver Id., Manitoba to southeastern Canada; south to the Gulf, New Mexico and Arizona. Also in the West Indies. Infrequent in the North, very abundant in Florida. Quite variable, especially in size, shape of branch leaves and abundance of paraphyllia.

Forma PAPILLOSUM n. f. Branch leaves serrate above, serrulate almost to base; papillae of leaf cells very large and prominent.

On dry ground on side of Mt. Cutler, Colorado, alt. 7500 ft. July 25, 1910 (Dr. H. S. Jewett). Dr. Best in a letter to the author states that he has nothing like it and that it is a good variety.

Var. *LIGNICOLA* (Kindb.) Best, l. c.

Thuidium lignicola Kindb. Ottawa Nat. 4: 63. 1890.

Plants larger; paraphyllia abundant; stem leaves reaching 1.3 mm. or more in length, broader and more abruptly narrowed to long slender acumination, which is frequently as long as the body of the leaf, the cordate-ovate base often as broad as long. "Capsules mostly shorter and thicker" (Best).

Apparently with the range of the species.

In Warwick Hammock, near Miami, Florida, the author collected an extreme form of this variety on moist limestone and bases of trees. The body of the stem leaves was about the shape of *f. 3, pl. 54*, M. H. M. but the slender acumination was rather longer than the body of the leaf in the lower stem leaves.

Var. *RAVENELII* Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 279, is merely a reduced form growing on sand or in other unfavorable habitats, principally in the South.

Var. *OBTUSUM* n. var.

Size and appearance of robust *microphyllum*, lower stem leaves often resembling in outline those of *T. virginianum*, others acute and still others obtuse with three unipapillate cells at apex, all broadly ovate; costa percurrent or nearly so, very stout; branch leaves ovate, gradually narrowed to an obtuse apex, some short-acuminate, serrulate above, costa ending below apex.

Type from Altamaha River swamp, north of Jessup, Georgia, July, 1895 (John K. Small, no. 5069). In herb. A. J. G.

Freaks occur in almost all forms of life. While the plants of this collection have all the appearance of normal healthy plants, it does not seem wise to make a new species on a single collection of a sterile moss until one is sure the variations are established.

11. THUIDIUM VIRGINIANUM (Brid.) Lindb. Musc. Scand. 36. 1868.

Hypnum Stereodon virginianus Brid. Bryol. Univ. 2: 576. 1827.

Hypnum gracile lancastriense Sull. & Lesq. Musc. Bor. Am. (Ed. 1) 278.

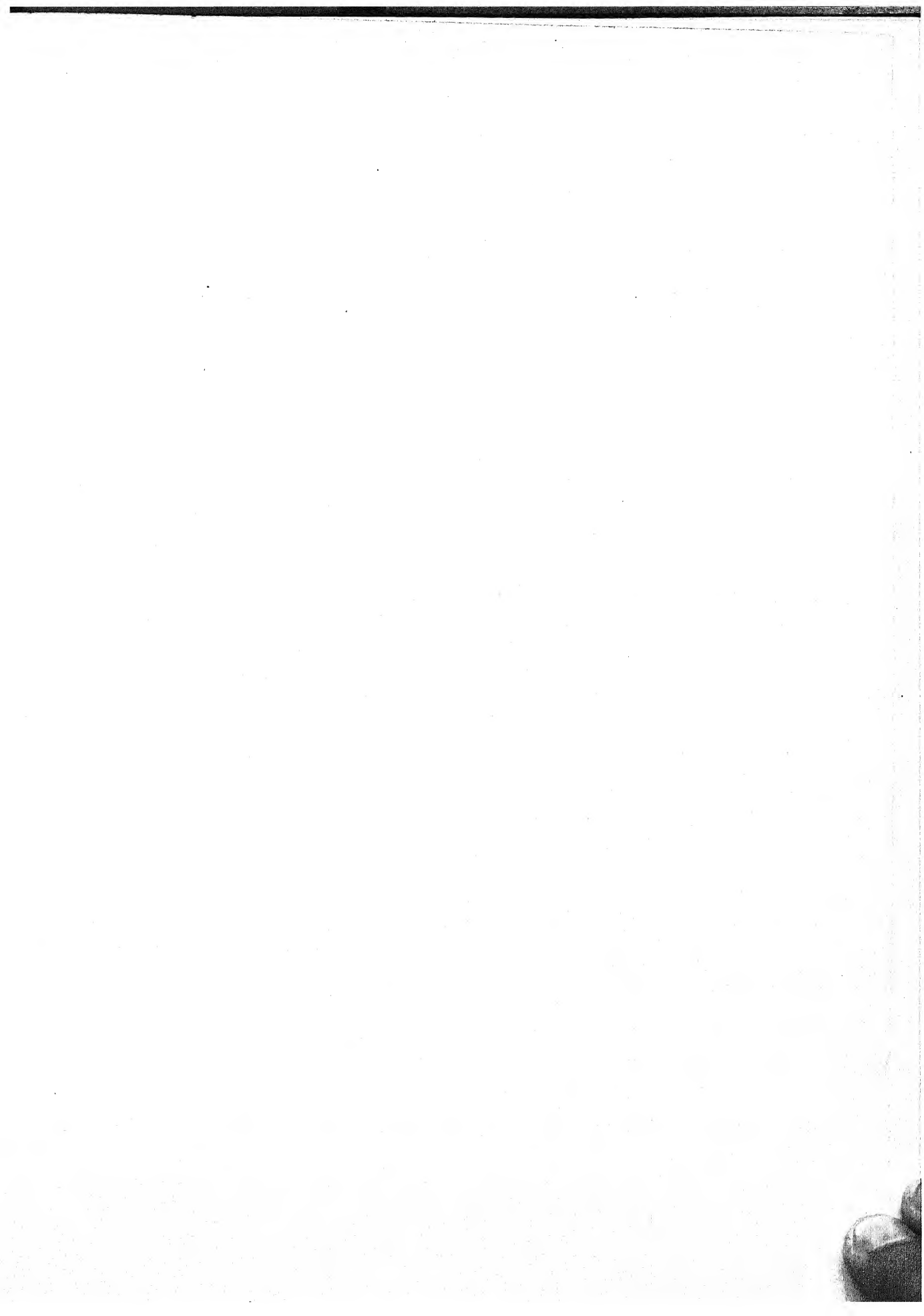
Thuidium punctulatum De Not. Erbar. Critt. Ital. no. 909. 1863; and Limpricht, Laubm. 3: 808. 1903.

Plants small to medium-sized, in intertangled mats, dark to dirty green; stems irregularly divided, 2-4 cm. long, creeping, pinnately branched; paraphyllia multiform, frequent on the branches; stem leaves rounded-ovate, 0.6-0.8 mm. long, abruptly short-acuminate, concave, rounded at base and narrowed to the insertion, scarcely plicate; margins plane or recurved below, serrate above, erose-dentate below; costa vanishing in the acumination; leaf-cells oblong-quadrate to hexagonal, with a single stout broad papilla, which is occasionally bifurcate; branch leaves crowded, about 0.4-0.6 mm. long, less abruptly narrowed to an acute apex or a broad short acumination, serrate above; perichaetial leaves erect, reaching 2.5 mm. long, margins denticulate-serrate. Monoicous; seta slender, 2-2.5 cm. long, dark-chestnut; capsule oblong-cylindric, somewhat lighter colored than the seta, curved, inclined to horizontal; urn about 2.5 mm. long, lid obtusely short-rostrate, about $\frac{1}{3}$ the length of the urn; annulus large; peristome perfect; spores in spring. Type locality, Virginia (Bannister and Mitchell).

ILLUSTRATIONS:—Bull. Torr. Bot. Club 23: *pl. 261*; M. H. M. *pl. 54*.

EXSICCATI:—Sull. & Lesq. l. c. and (Ed. 2) 411; Aust. Musc. Appal. 200; Grout; N. Am. Musc. Pl. 172.

On the ground or roots of trees in open woods; New England to Minnesota, south to Mexico, much less frequent than the preceding and often confused with it. As a rule it is smaller than *T. microphyllum*, with leaves more crowded. The stem leaves are often more slenderly acuminate than is shown in Sullivan's figures (M. H. M. *pl. 54*). The distinguishing characters of the species are, abundant paraphyllia, acute or abruptly short-acuminate leaves and large papillae. Slender forms occur with branch leaves more distant and more slenderly acuminate.



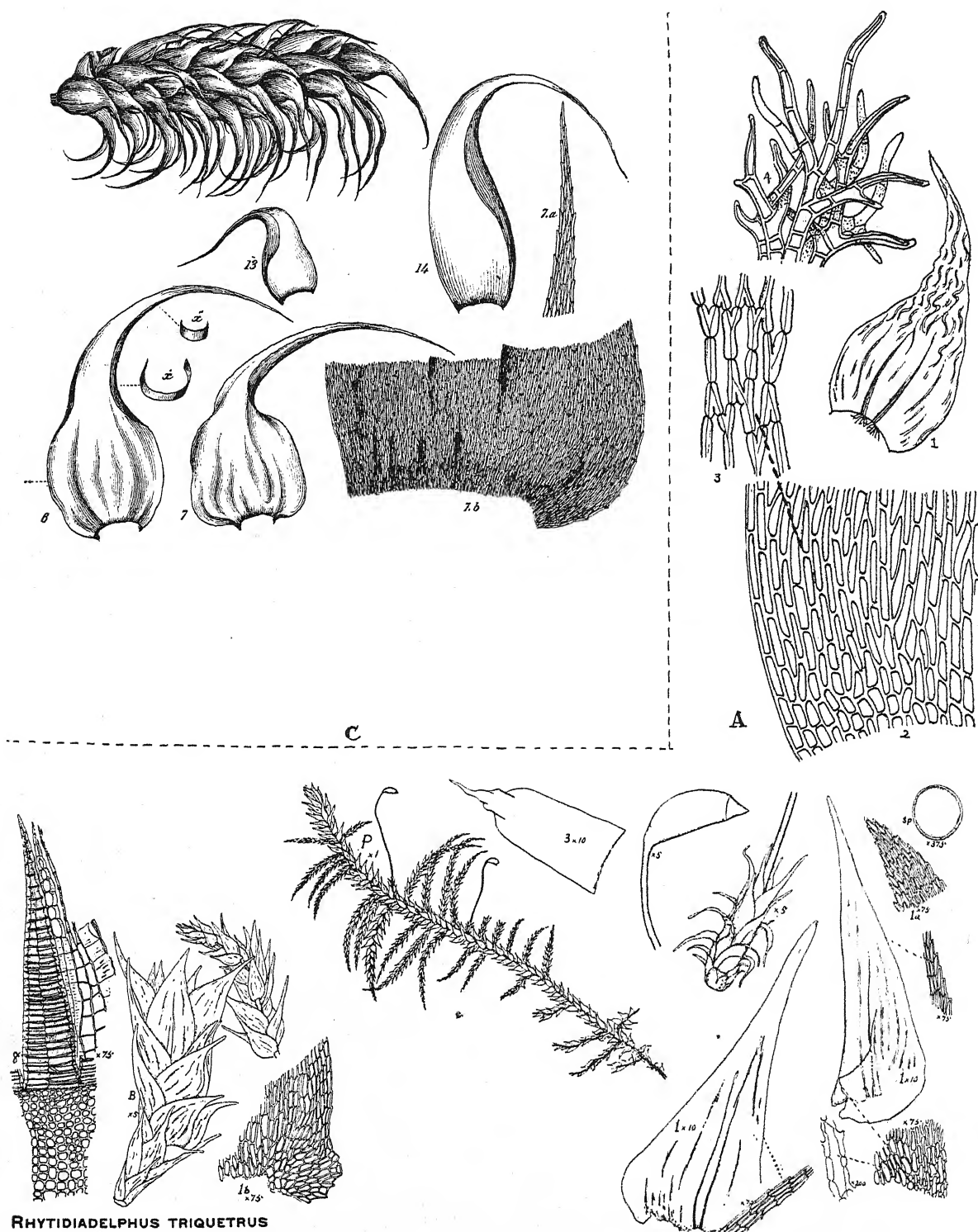


PLATE 30. *A. Rhytidiopsis robusta.* 1, stem leaf $\times 9$; 2, basal leaf cells $\times 175$; 3, leaf cells more enlarged; 4, paraphyllia $\times 175$ (from Engler & Prantl, Musci (Ed. 2) 2: 478. f. 761).

B. Rhytidiadelphus triquetrus. *P*, plant; *B*, branches; 1, 1*a*, 1*b*, etc., portions of leaves and leaf cells; 3, perichaetial leaf; 8, peristome; sp, spore; the capsule and seta are numbered 5. (From Jennings, Mosses W. Pa. pl. 43.)

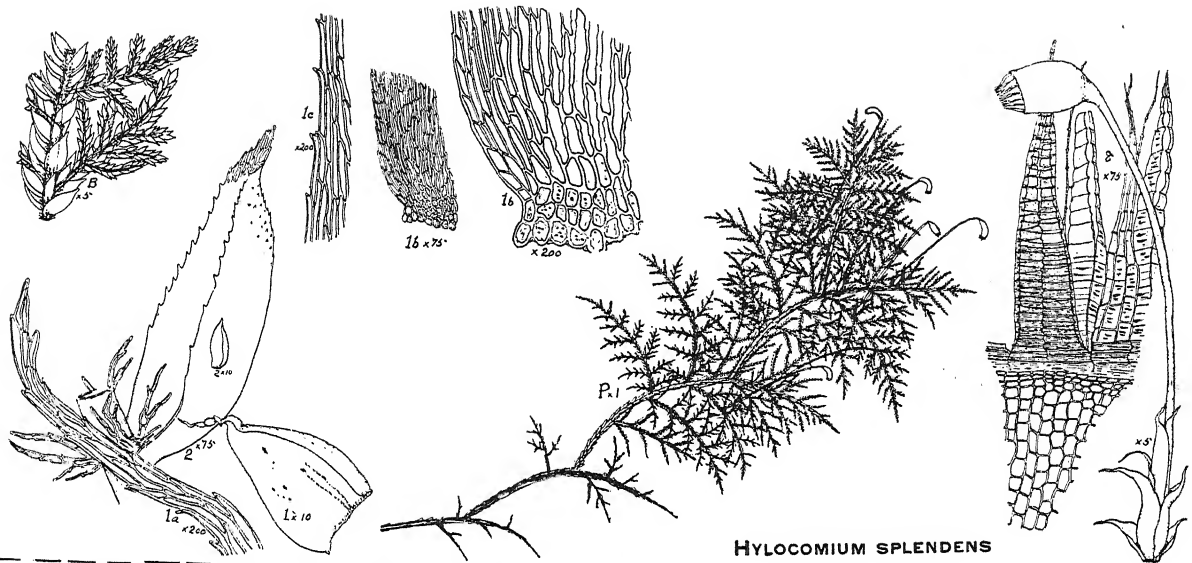
C. Rhytidiadelphus loreus. Above, portion of stem; 6 and 7, leaves; 7*a* and 7*b*, apex and base of the same; 14, perichaetial leaf (from Bry. Eur. pl. 490).

PLATE 31. *Hylocomium splendens*. 1, stem leaf; 2, branch leaf; 1b and 1c, portions of stem leaf. The other figures are self-explanatory. (From Jennings, l. c.).

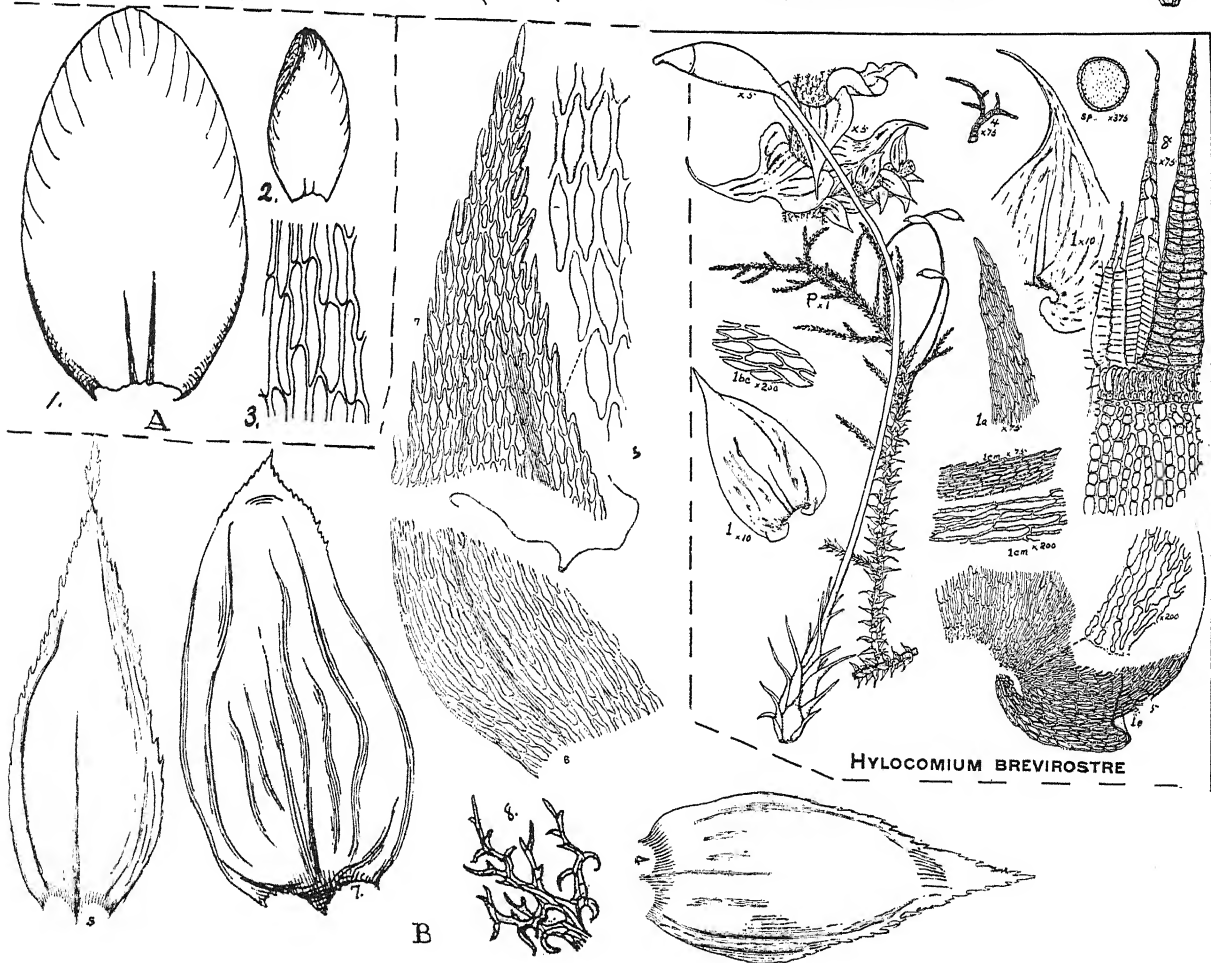
Hylocomium brevirostre. Explanation of the figures as above. (From Jennings, l. c. pl. 44.)

A. *Hylocomium alaskanum*. Leaves and leaf cells after Williams, Bryologist, 22: 1. f. 1.

B. *Hylocomium pyreniacum*. 4 and 5, leaves; 6 and 7, leaf cells. (From Sull. Icon. Musc. pl. 102.)
7 (a duplication) and 8, leaf and paraphyllia from Bry. Eur. pl. 489.



HYLOCOMIUM SPLENDENS



HYLOCOMIUM BREVIROSTRE

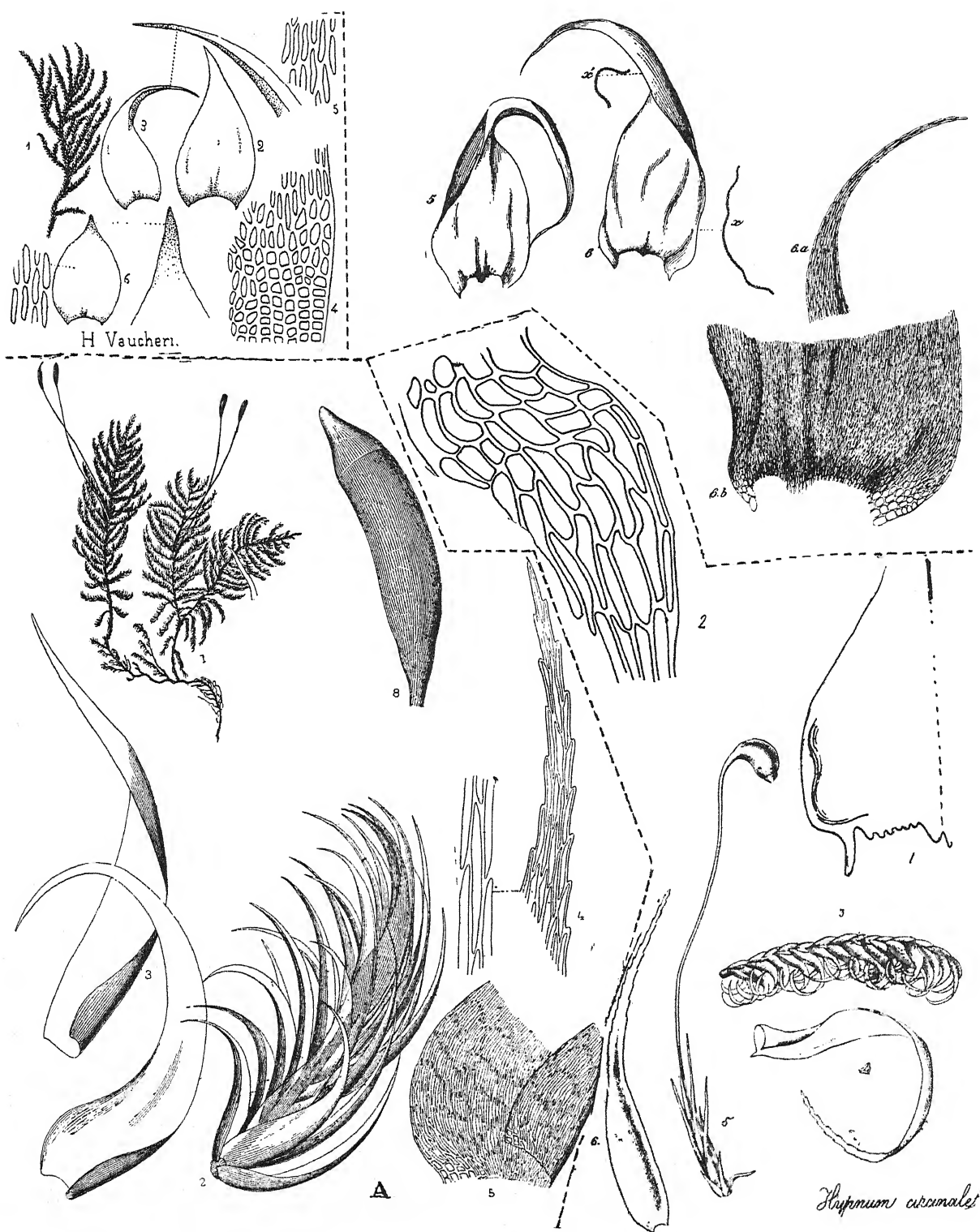


PLATE XXXII.

PLATE 32. A. *Hypnum subimponens*, from Sull. Icones Suppl. pl. 79. 1, plant $\times 1$; 2, part of a branch; 3, leaves; 4 and 5, cells of base and apex; 8, capsule.

Hypnum Vaucheri, from Husnot, Musc. Gall. pl. 117.

Hypnum circinale, figs. 3-6 (from Hook. Musc. Exot. pl. 107). figs. 1-2, leaf base $\times 100$ and angular cells $\times 400$ (by Mrs. Cleaves).

Upper right (lettering omitted by mistake), *Hypnum callichroum*; leaves and areolation (from Bry. Eur. pl. 506).

PLATE 33. A. 1, stem leaf of *Hypnum canadense* from Allen, Mosses Cascade Mts. 121b; 2, same of *H. canadense* from Vancouver Id., det. Kindb.; 3, same of *H. Dieckii*, det. Cardot, N. Am. Musci. Pl. 99. All $\times 30$. (Drawings by Mrs. Cleaves.)

B. *Hypnum subplicatile* (from Bot. Gaz. 22: pl. 5, as *H. implexum* R. & C.); a, entire plant, b, b, b, stem leaves, c, c, c, branch leaves; d, angular cells; e, leaf apex.

C. *Hypnum pallescens* (from Sull. Icones Suppl. pl. 68 as *Rhynchostegium Jamesii*); 2, part of stem with leaves; 4, leaf; 5, cross section of same; 6, leaf apices; 7, leaf base; 10 and 11, capsules.

(At bottom) *H. pratense* (from Bry. Eur. pl. 29); 4-7, stem leaves, 2, 3, branch leaves; 8, paraphyllia. The other figures are self-explanatory.

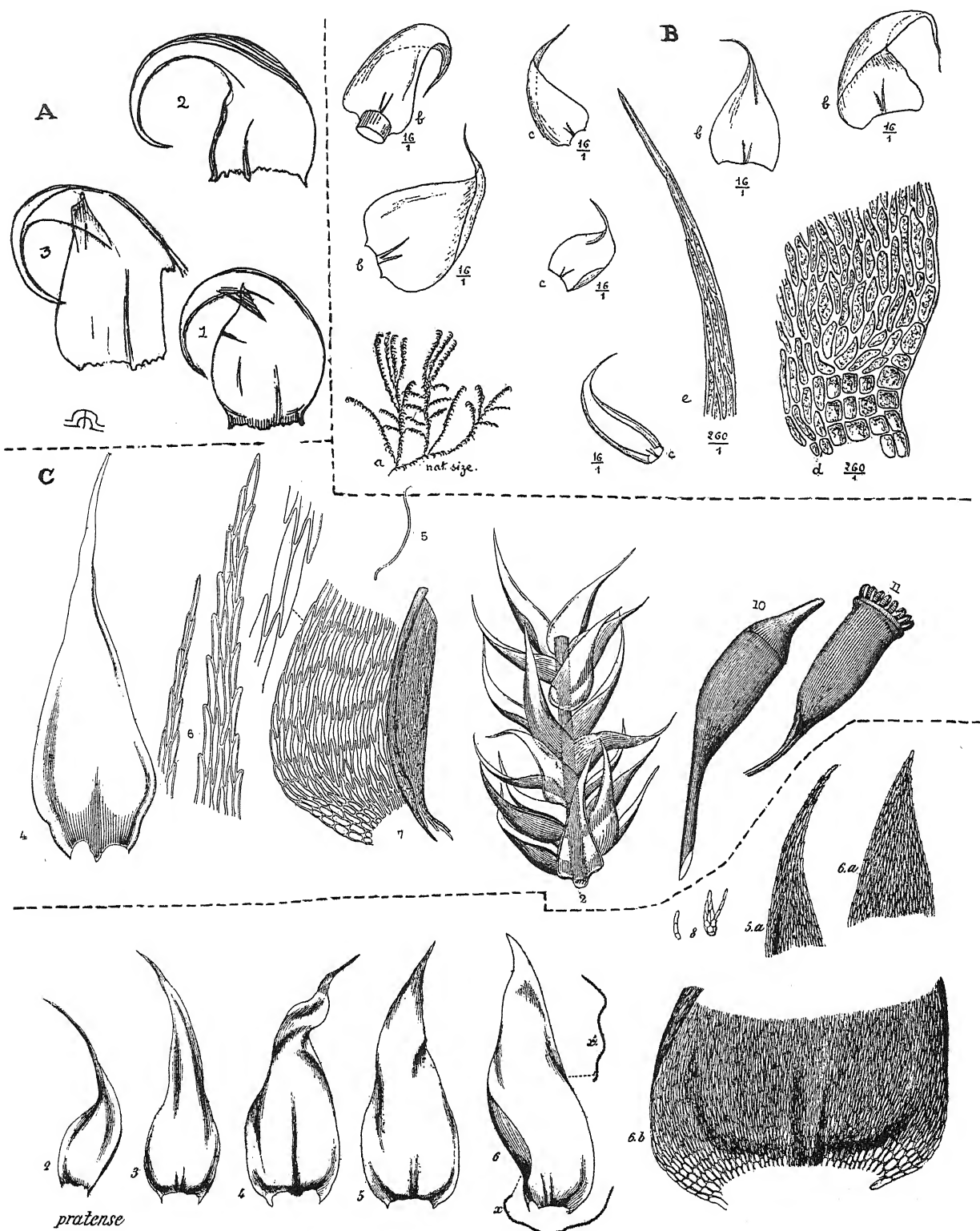


PLATE XXXIII.

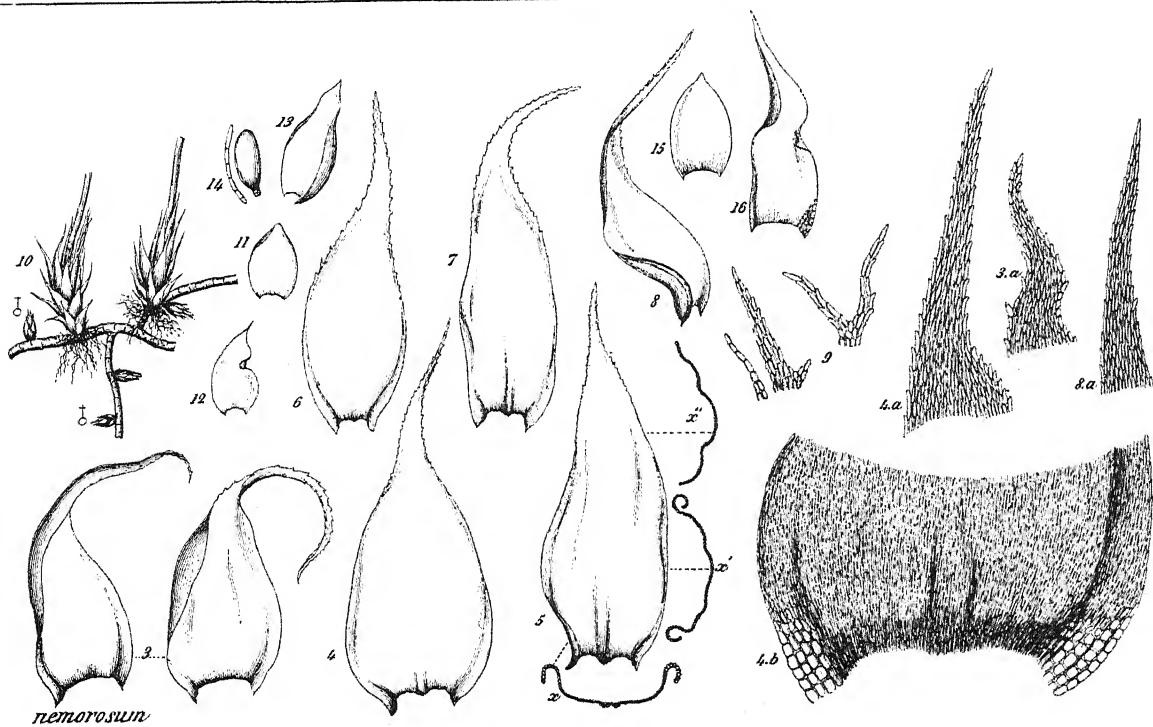
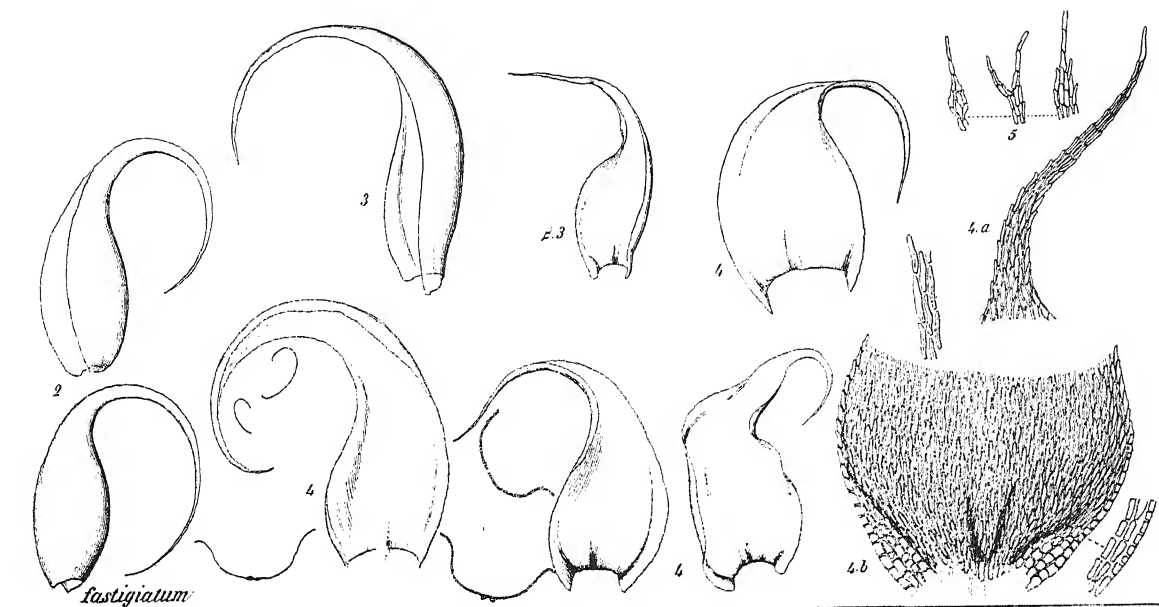


PLATE XXXIV.

PLATE 34. *Hypnum nemorosum* (from Bry. Eur. pl. 593) 3-5, stem leaves; 6-8, branch leaves; 9, paraphyllia; 10, portion of stem bearing antheridia and archegonia; 11-14, perigonal leaves and antheridia; 15-16, perichaetial leaves; 4b, basal cells of 4; 3a, 4a and 8a, apical cells of 3, 4 and 8, respectively.

Hypnum fastigiatum (Bry. Eur. pl. 589). 2-4, leaves; 4a, 4b, cells of base and apex respectively of 4; 5, paraphyllia.

PLATE 35. A. *Brotherella recurvans* (from Bryol. 6: pl. 1). 1, plant enlarged; 2, portion of branch; 3, leaf; 4 and 5, cells of base and apex of 3; 7, perichaetial leaf; 8, antheridia.

B. *Brotherella tenuirostris* (from Sull. Icones pl. 109, as *Hypnum cylindricarpum*). 1, plant, natural size; 6-7, leaves; 10, cells of leaf apex; 9, cells of leaf base; 13, perichaetial leaf; 15, 16, 17, capsule, calyptra and operculum, respectively; 18, 19, peristome.

E. *Hypnum revolutum*.

F. *Hypnum hamulosum*.

H. *Hypnum Bambergii*.

I. *H. canariense*.

J. *Hypnum procerrimum*.

Figures E-J, from Dixon and Jam. Handb. Brit. Mosses, pl. 59.

G. *Pylaisia polyantha*, from the same, pl. 51.

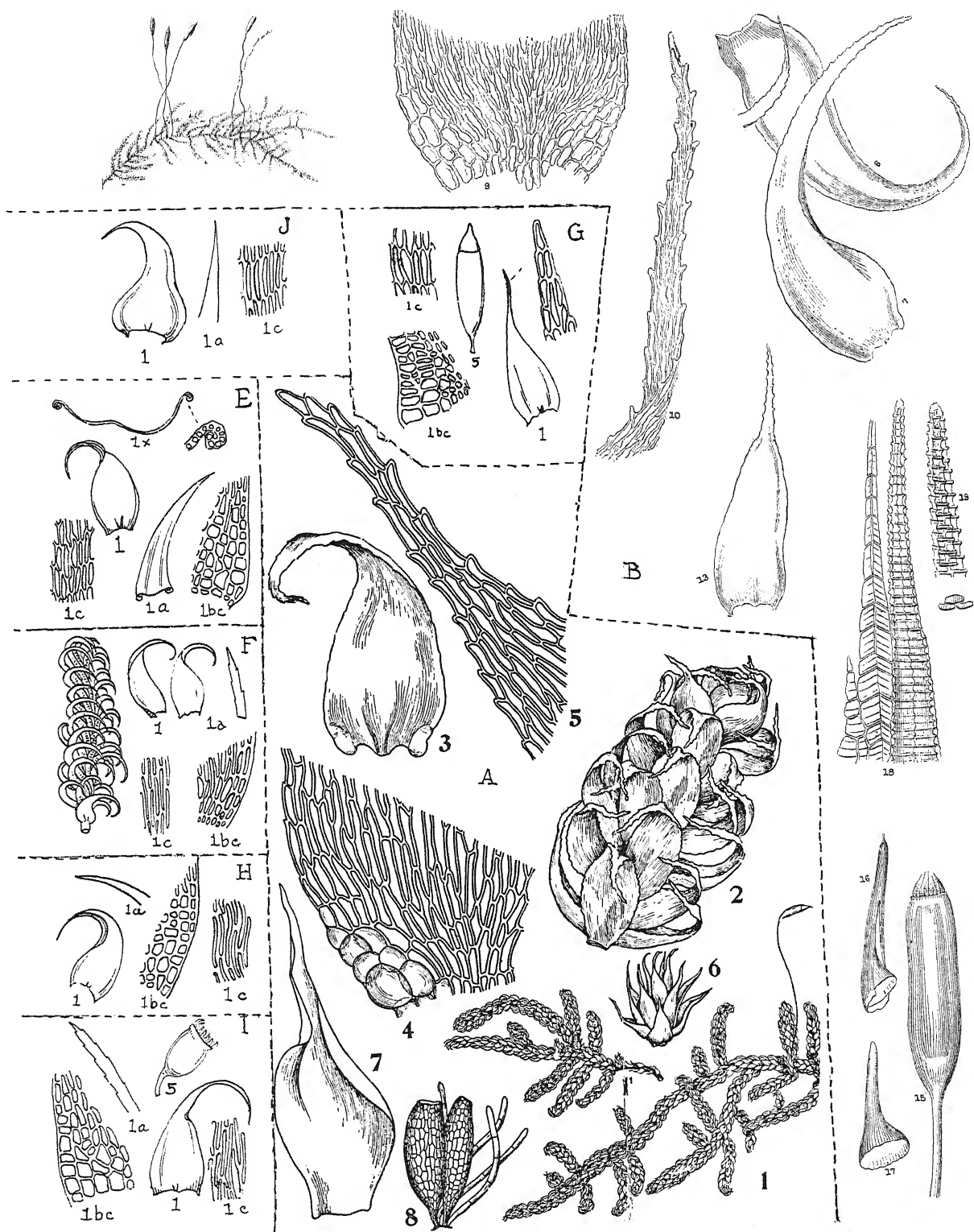


PLATE XXXV.

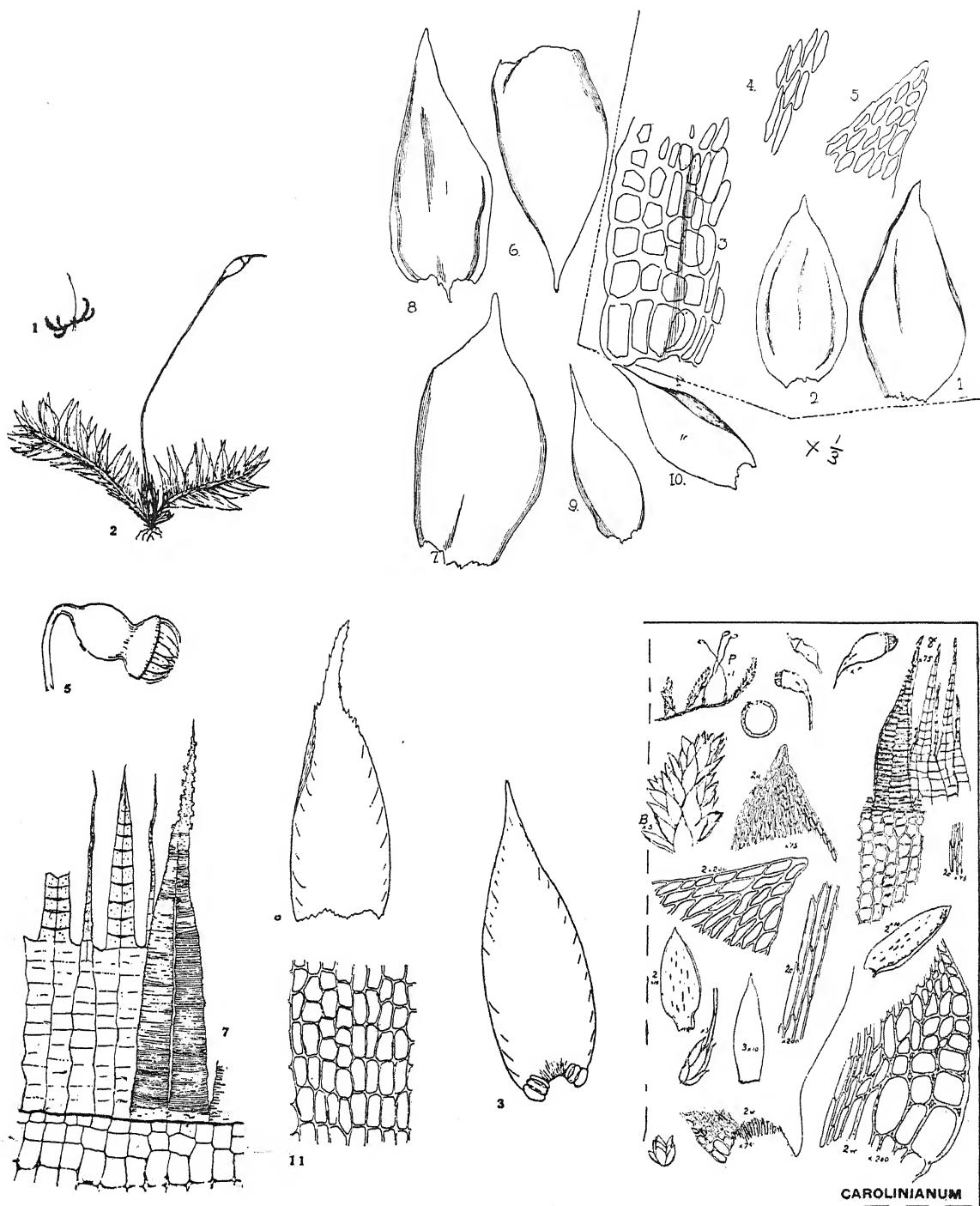


PLATE XXXVI.

PLATE 36. *Sematophyllum carolinianum*. The leaves shown are all branch leaves and the other figures are self-explanatory (from Jennings, Mosses W. Pa. pl. 48).

At the left, figures 1-11, *Sematophyllum Smallii*. 1, plant $\times 1$; 2, plant $\times 10$; 3, stem leaf $\times 36$; 5, empty capsule $\times 36$; 7, part of peristome $\times 300$; 8, inner perichaetial leaf $\times 36$; 11, median exothecial cells $\times 200$ (from Bryol. 23, pl. 6).

Above to the right, 1-5, *Sematophyllum caespitosum* (by Mrs. Cleaves). 1 and 2, leaves $\times 35$; 3, alar cells $\times 200$; 4 and 5, median and apical cells $\times 170$; 6-8, leaves of *Homomallium mexicanum latifolium*; 9, branch leaf of the same; all $\times 33$ and from the type; 10, leaf of *H. mexicanum* $\times 33$ (by Mrs. Cleaves).

- PLATE 37. A (lower left). *Thuidium abietinum*; leaves and basal areolation (from Bry. Eur. *pl.* 485).
B. *Pylaisia subdenticulata*. 2, branch. The other figures are self explanatory (from Sull. Icones, *pl.* 87).
C. *Plagiothecium Groutii*; a, plant $\times 1$; b, stem leaf $\times 26$, e, apex of same $\times 135$; f and g, median and basal leaf cells of stem leaf $\times 200$; b, branch leaf $\times 26$; d, apex of same; i, ripe moist capsule (from Bot. Gaz. 37: *pl.* 24).
D. Leaf of *Pylaisia Jamesii* $\times 30$. The shaded area represents quadrate alar cells.
Thuidium minutulum. 1, stem leaf; 2, branch leaf; s, a bit of stem with paraphyllia. The other figures are self-explanatory (from Jennings, Mosses of W. Pa. *pl.* 35).

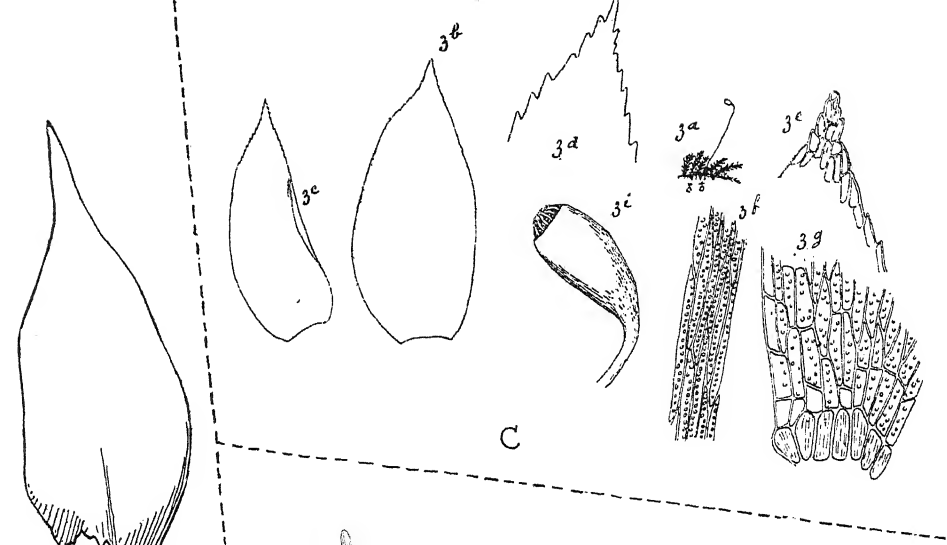
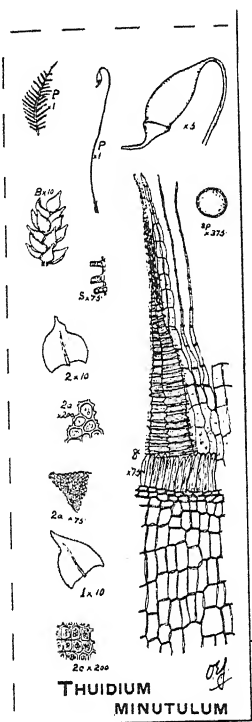


PLATE XXXVII.

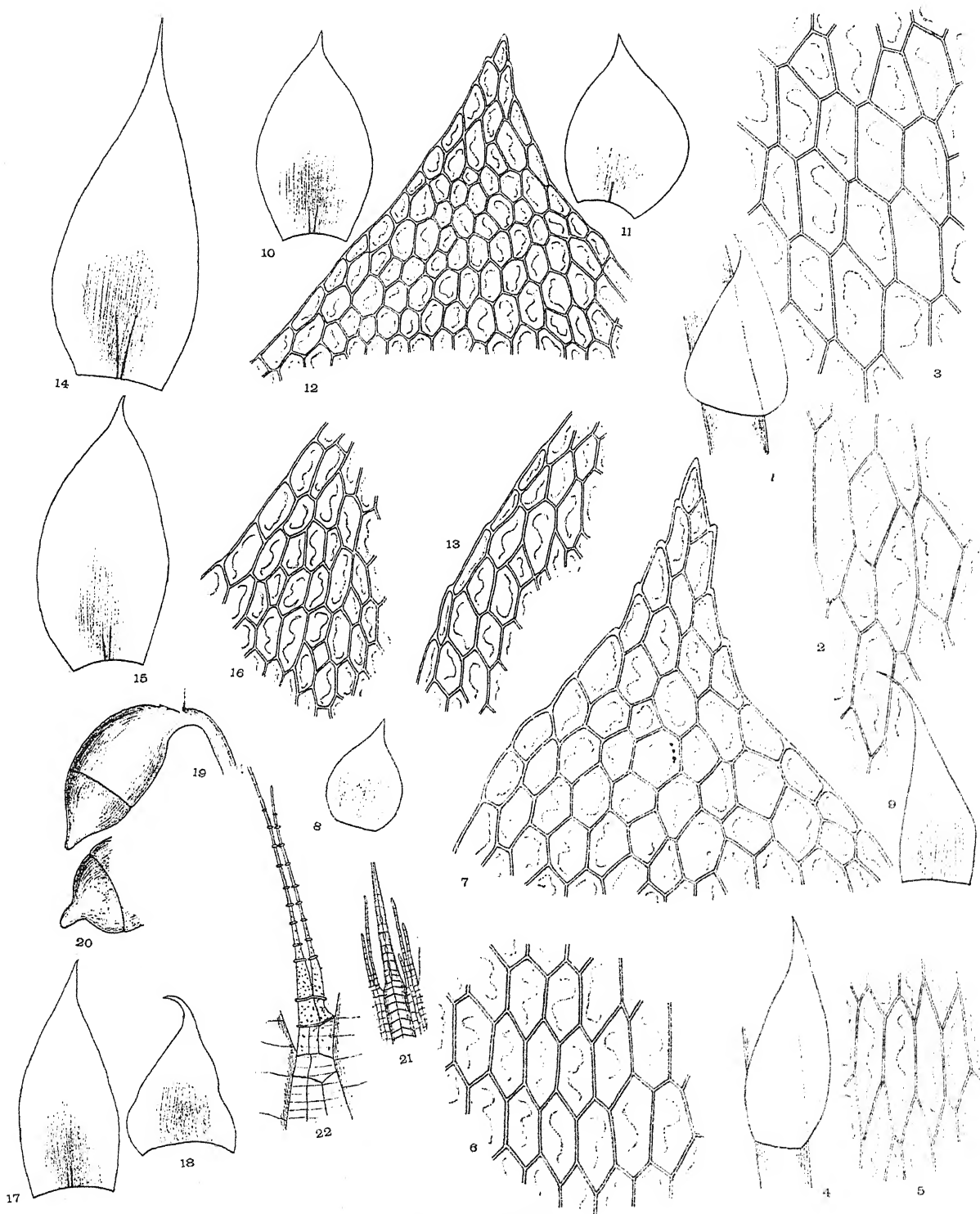


PLATE XXXVIII.

PLATE 38. *Vesicularia*. 1-3, 7-12, 17-22, *V. vesicularis*. 1, ventral branch leaf $\times 55$; 2, areolation of the same at $\frac{1}{3}$ from the apex $\times 360$; 3, areolation of a dorsal branch leaf $\times 320$; 7, apex of a dorsal branch leaf $\times 204$; 8, ventral branch leaf, towards base of branch $\times 41$; 9, perichaetial leaf $\times 20$; 17 and 18, two stem leaves from the upper side of the stem; 19, moist capsule $\times 20$; 20, dry operculum $\times 20$; 21, part of inner peristome $\times 120$; 22 cilia of the same $\times 204$.

14-16, *V. vesicularis Poeppigiana*. 14 and 15, dorsal and lateral branch leaf $\times 41$; 16, marginal areolation of lateral branch leaf at $\frac{1}{4}$ from the apex $\times 204$.

4-6 and 13, *V. amphibola*. 4, ventral branch leaf $\times 55$; 5, areolation of same at $\frac{1}{3}$ from apex $\times 320$; 6, areolation of dorsal branch leaf at $\frac{1}{3}$ from apex $\times 320$; 13, marginal areolation of lateral branch leaf at $\frac{1}{4}$ from the apex $\times 201$ (all from Bull. Torr. Bot. Club 31: plates 13 and 14).



PLATE 39. A. *Ectropothecium caloosiense*. From drawings in the herbarium of The New York Botanical Garden made from the type. (By permission of the Director.)

B. *Stereophyllum Wrightii* (from Sull. Icones, pl. 127).

C. *Plagiothecium Roeseanum* (from Sull. Icones, pl. 126).

D. *Plagiothecium latebricola* (from Dixon and Jam. Handb. Brit. Mosses, pl. 56).



PLATE XXXIX.

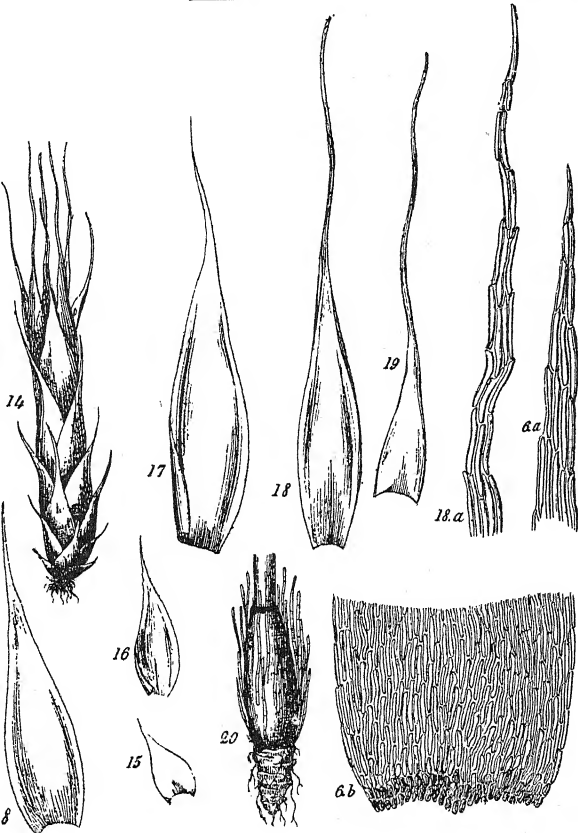
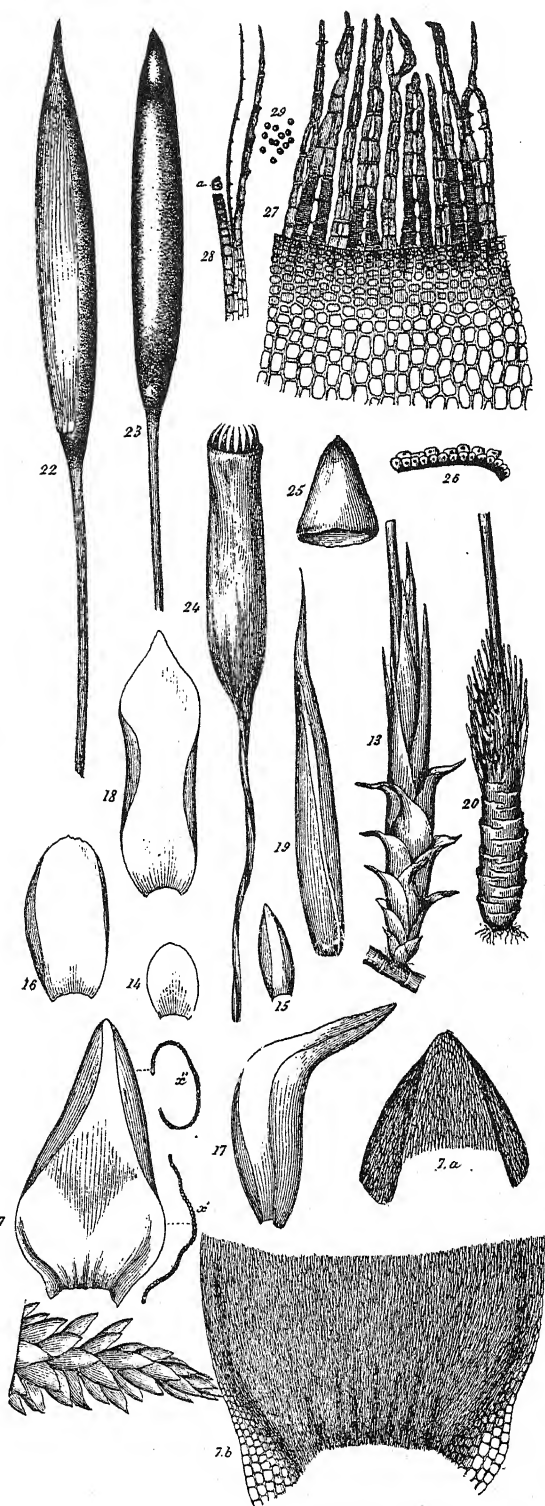
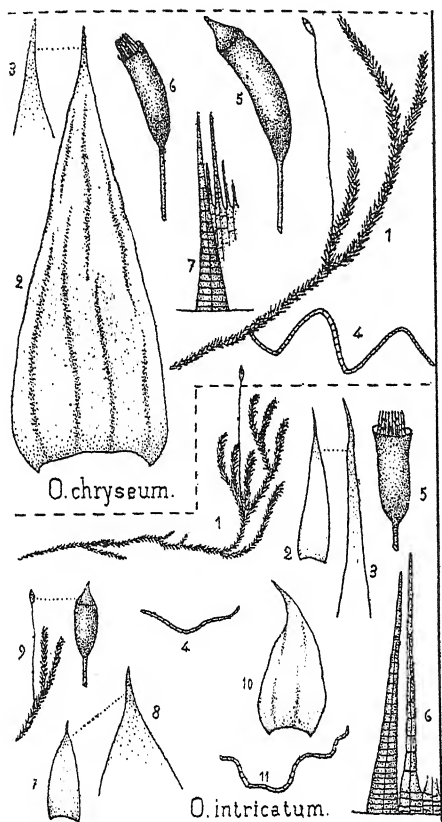
PLATE 40. Leaves and areolation of leaves of *Plagiothecium laetum*, *P. undulatum* and *P. piliferum*
(from Bry. Eur. plates 495, 506 and 496, respectively).

PLATE 41. *Holmgrenia chrysea*. 2, leaf; 4, cross section of leaf; other figures self-explanatory (from Husnot, Musc. Gall. pl. 90).

Holmgrenia intricata. Figures 1-6. Figures 7-9 represent Husnot's idea of *H. stricta*; 10 and 11. *H. intricata* var. *binervula* (from Husnot, l. c.).

Lower left, *Holmgrenia intricata*. 8, leaf; 6a and 6b, apex and base of same; 14, perichaetium; 15-19, perichaetial leaves (from Bry. Eur. pl. 462); 17 also well represents a common type of branch leaf.

Right, *Entodon orihocarpus* (from Bry. Eur. pl. 465).



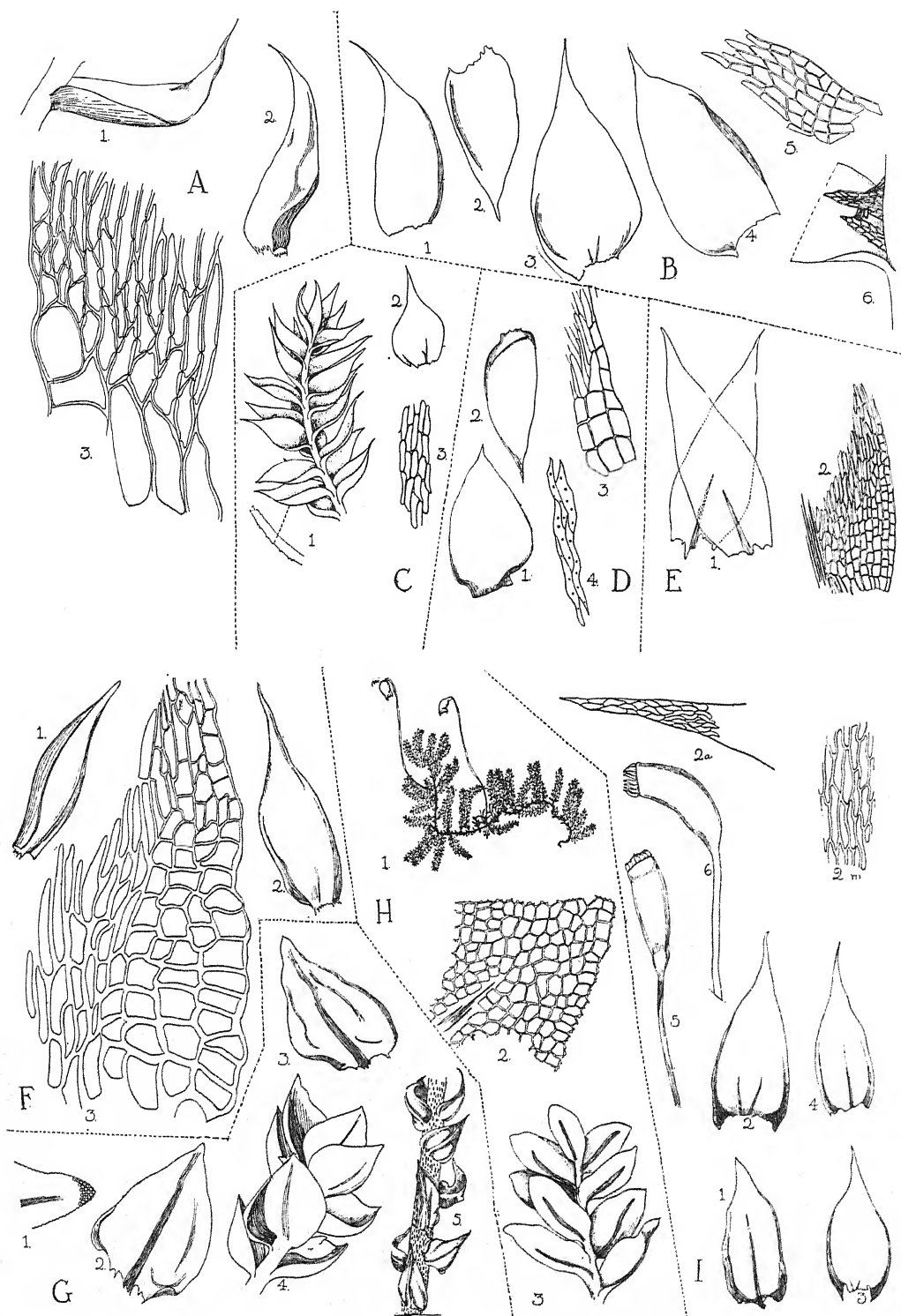


PLATE XLII.

PLATE 42. A. *Plagiothecium Seligeri*. 1 and 2, leaves $\times 21$; 3, alar cells $\times 200$.

B. *Plagiothecium deplanatum*. 1-4, leaves $\times 21$; 1, from Musc. Bor.-Am. (Ed. 1), 396; 2, a short-acuminate leaf from a specimen from Burlington, Vt.; 3, leaf from Musc. Pl. 74; 4, leaf of var. *ovatum* from Arizona; 5, alar cells of 3×133 ; 6, axillary paraphyllia $\times 21$.

C. *Mittenothamnium diminutivum*. 1, branch $\times 21$; 2, stem leaf $\times 21$; 3, median leaf cells $\times 200$.

D. *Taxithelium planum*. 1, stem leaf $\times 21$; 2, branch leaf $\times 21$; 3, alar cells $\times 200$; 4, median cells $\times 200$.

E. *Stereophyllum Donnellii*. 1, leaves $\times 21$; 2, alar cells $\times 166$ (from the type).

F. *Platygyrium fuscoluteum*. 1, leaf from the type $\times 21$; 2, leaf from a plant from Arizona (Bartram) $\times 21$; 3, alar cells $\times 300$.

G. *Thuidium Alleni*. 1, apex of stem leaf $\times 166$; 2, stem leaf from plant from Florida; 3, stem leaf from plant from type locality, both $\times 21$; 4, portion of branch $\times 21$; 5, portion of stem $\times 8$.

H. *Thuidium involvens*. 1, plant $\times 2$; 2, apex of leaf $\times 200$; 3, branch $\times 21$.

I. *Tripterocladium leucocladulum*. 1, branch leaf $\times 21$; 2, stem leaf $\times 21$, shaded areas at basal angles indicate area of quadrate cells, both 1 and 2 from the type; 2a and 2b, apical and median cells of 2 $\times 200$; 3 and 4, leaves from type of *T. compressulum*; 5 and 6, capsules of *T. leucocladulum* from Idaho, both from the same tuft of plants, $\times 18$. (All figures in Pl. 42 were drawn by Mrs. Howard Cleaves.)

PLATE 43. A. *Plagiothecium Seligeri*. 1, leaf; 1a and 1b, apical and basal cells of the same (from Bry. Eur. pl. 500).

B. Portion of branch, leaves and leaf cells of *Entodon brevisetus* (from Sull. Icones pl. 96).

C. Portion of stem, leaves and leaf cells of *Plagiothecium subfalcatum* (from Sull. Icones Suppl. pl. 67).

D. Leaves and leaf cells of *Entodon Drummondii* (from Sull. Icones pl. 94).

E. Leaf, leaf cells and capsule mouth of *Entodon Sullivantii* (from Sull. Icones pl. 95).

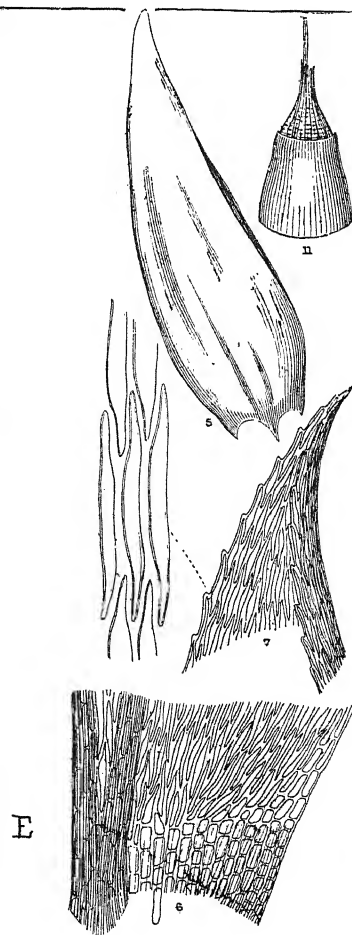
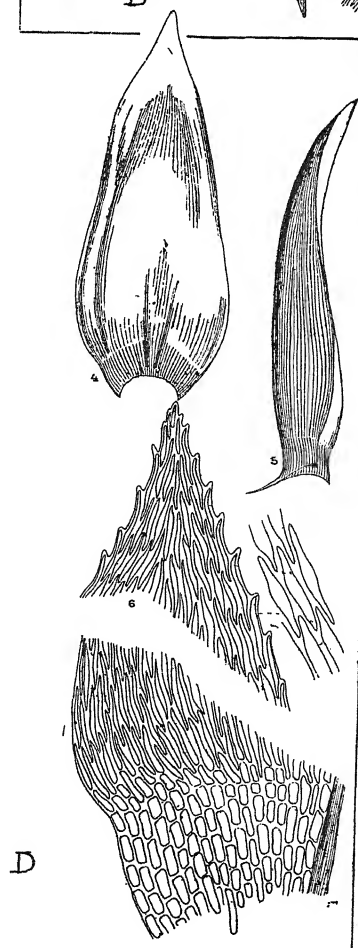
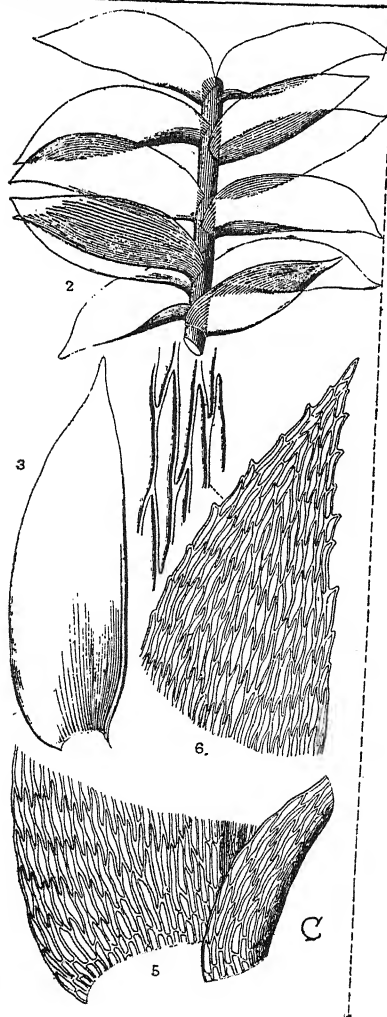
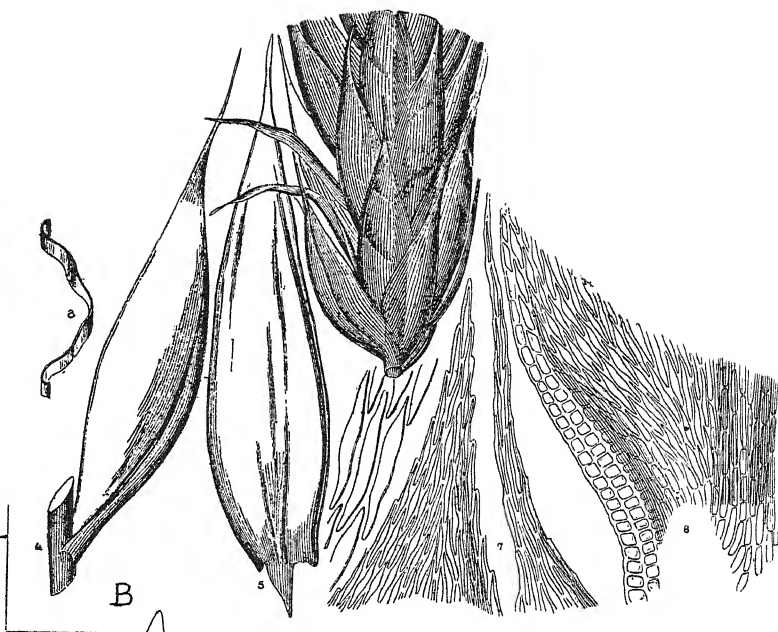
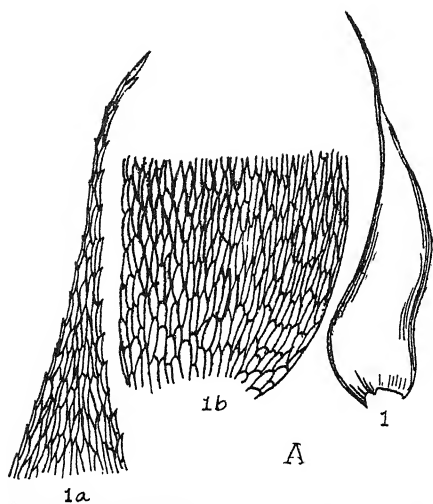
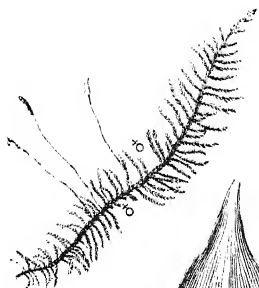
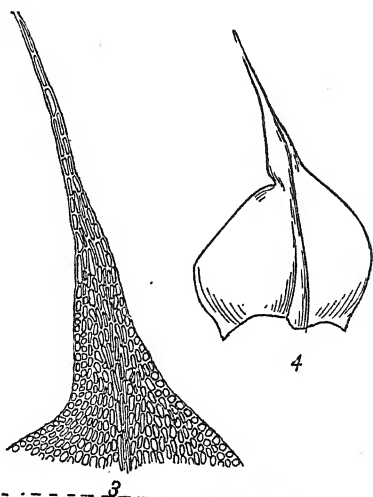
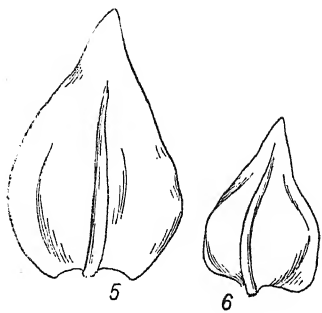
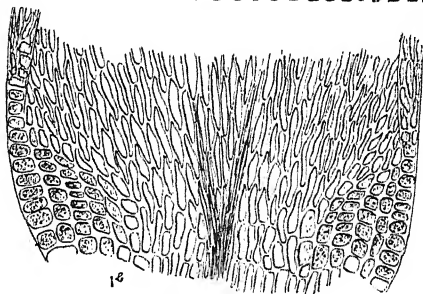
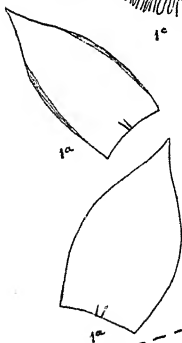
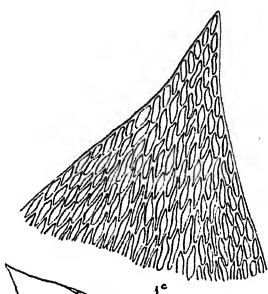
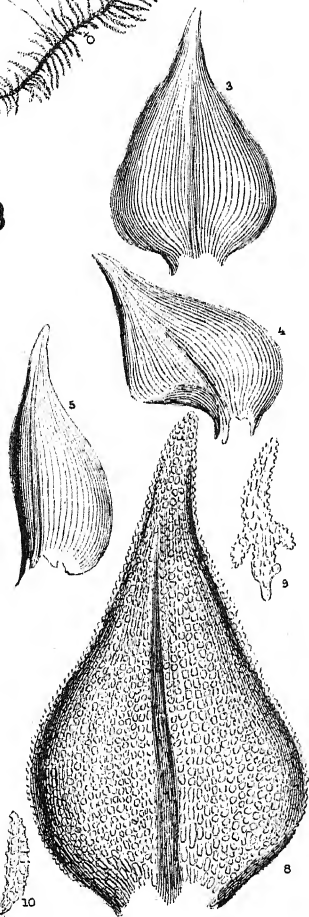


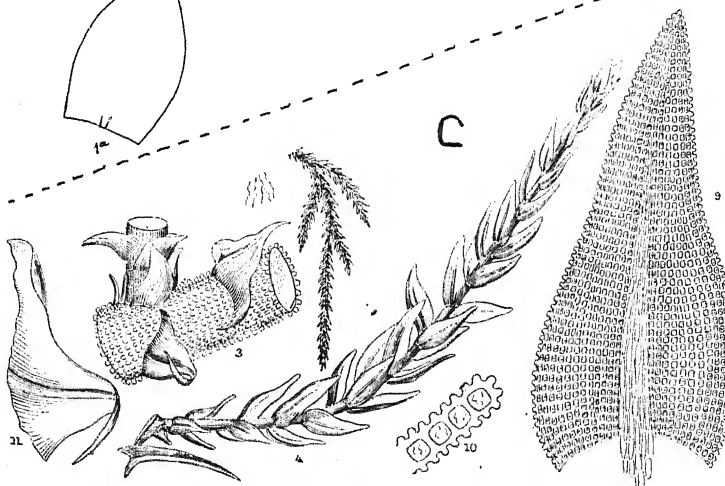
PLATE XLIII.



B



D



C

PLATE XLIV.

PLATE 44. A. *Thuidium Philiberti*. Plant, stem leaf, apex of the same and branch leaves (from Bull. Torr. Bot. Club 23: pl. 260).

B. *Thuidium scitum*. Plant, leaves, leaf cells and paraphyllia (from Sull. Icones pl. 99).

C. *Thuidium pygmaeum*. Portion of stem, branches, apex of stem leaf, branch leaf showing cells, and portion of cross section of leaf (from Sull. Icones pl. 98).

D. *Pterogonium ascendens*. Leaves and leaf cells from drawings made by Cardot from type specimens in Herb. Boissier, collected in Pennsylvania by Muhlenberg (from Bull. Herb. Boissier 7: pl. 8. 1899).